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## CONTENTS.

ILLUSTRATED ARTICLES: PAGE.
Insulating Overhead Wires. 186
Steno-Telegraphy. 187
Electrical Lighting by Means of Low-Resistance Glow Lamps (Continued). 188
A Compact Electric Lighting Plant. 189
A Novel Friction Clutch for Electric Lighting. 189
Contact-Maker for Electric Clocks. 191
A Novel Railway Station Indicator. 191
Professor Thompson's Magneto Telephone. 193
REVIEWS OF NEW BOOKS:
"L'Annuaire de l'Observatoire de Montsouris". 186
CORRESPONDENCE:
Winding for Dynamos. 186
The Nipher Affidavit and the New Orleans Telephone Suit. 192
The Franklin Institute Dynamo Tests. 192
Some Light on the Franklin Institute Friction Measurements. 192
The Hanging of Lamps Across Streets. 192
Battery and Line. 193
The Best Kind of Lightning Rod. 193
Volts and Ampères. 193
Sizes of Wire for Lighting. 193
Dynamo Patents and Pronunciations. 193
The Efficiency of Electric Motors. 193
EDITORIAL PARAGRAPHS. 185
MISCELLANEOUS:
Underground Work in Chicago. 186
MISCELLANEOUS: PAGE.
Suits to Annul Patents. 186
The Cut in Cable Rates. 187
Electric Lighting on Pacific Coast Steamships. 187
The Electric Light in Photo-Engraving. 188
The Telephone in the State of New York. 188
Electrical Experiments and Measurements Abroad. 189
Telephone Troubles in Indianapolis. 189
Electric Church Bells. 189
The Automatic Telephone Toll-Collecting System. 190
Automatic Collection of Telephone Toll. 190
A Thermopile and Galvanometer Combined. 190
Continuing the Pan-Electric Investigation. 190
An Anti-Induction Telephone Cable. 191
On the Running Down of Batteries as Indicated by Their Performance of Mechanical Work. 193
DEPARTMENTS:
New York Notes. 194
New England Notes. 194
Philadelphia Notes. 194
Western Notes. 194
The Telegraph. 195
The Telephone. 195
The Electric Light. 195
Applications of Power. 195
Miscellaneous Notes. 195
Personals. 195
Sparks and Flashes. 195
Stock Quotations. 195
Business Notices. 195
Our Illustrated Record of Electrical Patents. 196

New Advertisements.

PAGE.
A. T. Smith—Electric Lava Gas Tips. iii
J. H. Bunnell & Co.—Telegraph Instruments, etc. iii
The United States Electrical Co.—The "Little Giant" Electric Motor iii
Eastern Electric Cable Co.—Anti-Induction Telephone Cables. v
Austin G. Day—Removal. vi
Schaefer Electric Manufacturing Co.—Incandescent Lighting. vi
California Electrical Works.—Electrical Supplies. 196
National Electric Light Association—Executive Committee Meeting. vii
The Tarbox Time Register Co.—Electric Watch Clock. vii
Thos. R. Taltavall—"Caligraph" Writing Machine. vii
The Consolidated Telephone Co.—The Shaver Telephone System. xi

**Vol. VII. NEW YORK, APRIL 24, 1886. No. 17.**

IT is about time that some one drew the dividing line, if it can be drawn, between "high" resistance and "low." Mr. Bernstein's paper on "Lighting by Means of Low-Resistance Glow Lamps" serves to raise the point again. Perhaps the Patent Office, having granted patents in which "high" and "low" play an important part, can help to a satisfactory definition and limitation.

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IN view of the rapid advance that electric lighting has made here for all manner of purposes and in the greatest variety of situations, it is indeed remarkable that so little has been done in lighting trains. It is true a few trains are now regularly lighted by this means, but wonted enterprise seems to have found some barrier to progress really serious. What this barrier is, it would be difficult to say, for the electrician is amply able to satisfy all the demands that may be made on his ingenuity by the undertaking. A traveler in a car lighted by electricity was recently heard to ejaculate that if the railway authorities would only make the cars as steady as the light, rapid locomotion would be a pleasure; and the fact is, that the electric light is the only one suited to modern ideas of convenience in travel.

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REPORTS have been in circulation that if a general boycott of Mr. Jay Gould were ordered, the first attack would be made through the operators of the Western Union. The stock of the company has been "sold down" on the bare suggestion of such a strike, but it is said positively that while there may be bitter feeling in some quarters, no general action of the kind is contemplated.

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PROF. NIPHER contributes a letter to our columns this week in regard to an important point raised during the progress of the recent New Orleans telephone litigation. Prof. Nipher states his side of the case very vigorously, and is evidently anxious to be justified in the eyes of the public, no matter how dark the aspect in which, on the other hand, some prominent men are presented to view.

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STENO-TELEGRAPHY is one of the most interesting among the many methods devised for increasing the capacity of telegraph lines. It may be said to be another form of code signaling in which an abbreviated sign may indicate a word or even a sentence. The manipulation on this system naturally requires long practice, which is one of its drawbacks, but the results obtained compare quite favorably with those of some other fast systems. We publish an illustrated article on the subject this week.

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SOME of the critics of the railway strikers in the Southwest cannot find terms harsh enough to describe the destruction of property; but if these critics want to find a set of men really worthy of such a display of indignation they had better turn their gaze onthe City "Strikers" of Indianapolis, whose "temper is to inflict as much damage as possible" on a telephone company that has been conducted from first to last as a sound, legitimate and fair business enterprise. We know of few more disgraceful exhibitions of communistic vandalism than this malicious wrecking of the telephone system in Indianapolis.

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WE have already given in recent issues some very interesting articles as regards the development of electrical applications on the Pacific Coast. To-day, we supplement them by another, dealing with the subject of electric lighting on the steamships that navigate along the American shore of the Pacific. The vessels referred to are very fine specimens of marine architecture that any country might be proud of, whether it has a navy or not; and it is pleasant to find them lighted by the only illuminant that can do them justice. It will be observed that the Edison system was installed on one of them as far back as 1880.

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OTHER means of coercion having failed of their purpose against the Central Union Telephone Company in its resolve not to do business in Indiana at the unprofitable rate fixed by State law, an effort is now made to get telephones for nothing by changing the patent law of the country. Mr. Holman has introduced a bill rendering it illegal for any corporation acting under United States patent to withdraw any machine from public use in a State without the consent of the Legislature, although its tariff may have been arbitrarily fixed by the said Legislature. This action on the part of Mr. Holman will arrest the attention of all interested in patents, and show how far-reaching is the injustice to inventors of which the State of Indiana has been guilty; and thus the honorable member may be a public benefactor in a way he did not desire or anticipate.

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THE long-talked-of cut in cable rates, will, it is now understood, begin May 1, the cable pool having come to that decision last week. The reduction, aimed as a blow at the Mackay-Bennett cables, will be from 40 cents to 12½ cents a word on general business, and from 20 cents to 6 cents on press business. It is said, too, that the Western Union Company has agreed to a reduction in its land rate per word, so as to lessen the burden of the cables at the lower prices. The Baltimore & Ohio Telegraph Company has an interest in the "cut," as it does the land line service for the Mackay-Bennett cables. While as part of the public we are glad to be able to do our cabling cheaply, we are sorry to see this kind of desperate competition resorted to. It certainly will not help the Western Union Company to make good its deficit of, say, about $250,000 on its American cable guarantee, and it is not likely to achieve its purpose, that of breaking down the Mackay-Bennett opposition.

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The question of proper insulation of telegraph lines may be said to be as live a one to-day as it was in the infancy of telegraphy. Great progress has been made, it is true; but even with all modern appliances, telegraphic lines are very variable and capricious things. When Varley came over to America in 1869 to investigate the condition of the Western Union lines, he found that from one cause or another, but principally through the lack of proper insulation, hardly one-fourth of the existing lines were available for active service. Mr. David Brooks, in another column, gives a very interesting account of his labors in connection with the work of providing adequate insulation for telegraph lines. Speaking, as he does, with the experience gained by nearly forty years of experiment, Mr. Brooks' opinions carry considerable weight; and his missteps not less than his successes, as described by himself, will aid the beginner in this line of electrical work, as well as interest all who are now grappling with the problems of underground work.

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THE beautiful arch of electric lights upon the Brooklyn Bridge, which is the delight and admiration of all travelers in New York harbor or over the bridge, has from the beginning, it is alleged, given offense to the pilots of our river craft, who maintain that the great brilliancy blinds them and renders the lights of vessels indistinct. Recently one of our maritime journals has drawn attention anew to the subject, and it asserts that not until a collision will have occurred will the evil be remedied. These opinions from parties who have no ill-will toward the electric light deserve consideration, and if the lights are a source of danger steps should be taken to render them harmless to the sailing fraternity. A very simple remedy is at hand, which although it may detract from the beauty of the scene would nevertheless be effective. The remedy lies in merely inclosing the lamps in hoods or screens so that their light should only be shed upon the bridge, cutting off their rays in all other directions. In this way the object for which the lights are designed would be accomplished without interfering with the shade-loving pilot. Our sea-going friends need not expect to see the lights removed. They have been put up to stay, and the very complaint against them proves their efficiency.

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WHATEVER may be the outcome of the suit to annul the Bell patent, the proceedings will possess great value in determining the province and power of the government to interfere in such matters by coming to the aid of private litigants. That the government should, if it does not already, possess the power to annul a patent upon sufficient grounds, seems to be generally conceded, as will be observed from the reports of the Congressional Committee; but the conditions under which it should be called upon to act are not clearly defined. Statistics show that a larger part of the industrial wealth of this country is founded upon patents, and it becomes of the greatest importance to have the true, real status of a patentee defined. Government interference in private matters is, as a rule, to be deprecated, and in this case not less than in others, but it cannot be denied that circumstances may arise in which the interests of the people at large may require the action of the government in preventing abuses. These conditions seem at present to be vaguely understood, but the recent discussion and inquiries will probably lead to the enactment of some law which shall clearly set forth the power of the government. Leaving out of consideration the merits of the points at issue in the present controversy, there can be no doubt that the present instance has shown to what extent the aid of the government may be invoked by unscrupulous speculators if they can gain the influence of government officials, and we sincerely hope that the law may be so changed as to make a scandal such as that now under investigation an impossibility.

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WE had ventured to hope that the discussion in relation to the Franklin Institute dynamo tests had found its conclusion in the reply of Ensign Louis Duncan, on behalf of the Franklin Institute, which appeared in our last issue. But in another column we print additional communications upon the subject, one of which possesses peculiar v[illegible]-since it throws some light on the principal point raised by Mr. Heinrichs, viz., the measurement of the friction of the armature. Mr. Kelly shows that, by employing an entirely different form of dynamometer from that used at Philadelphia, the results obtained do not differ materially, and the difference actually shown may be easily traced to the employment of the belt. With due respect to the able defenders who have thus far supported the Franklin Institute, we must say that Mr. Kelly has brought forward the best argument yet advanced, and that is, *an actual demonstration*. As we know Mr. Kelly to be an intelligent and conscientious experimenter, with a horror of newspaper letter writing, we have no hesitation in accepting his remarks and measurements as correct. They prove undoubtedly that in the highly-finished dynamo only an exceedingly small power is consumed in friction. The Franklin Institute has naturally been able to fall back only upon its own tests, and it is therefore gratifying to see such an elaborate work substantiated. The thought naturally suggests itself that the Institute might completely disarm all criticism by recalibrating its dynamometer, by running it through a large range of speeds and powers. If after that its indications do not differ materially from those obtained by running it at the speeds employed in the first calibration, no room is open for further comment on this score. We sincerely hope that the Institute may see its way clear to such an undertaking, and thus definitely settle an important discussion which to it must have been from the first a most unwelcome one, and is now becoming wearisome.

## REVIEWS OF NEW BOOKS.

L'ANNUAIRE DE L'OBSERVATOIRE DE MONTSOURIS, pour l'an 1886. Paris, Gauthiers-Villars. 1886. 600 pp., 18mo.

This annual gives a large amount of meteorological information collected at the admirably equipped observatory of Montsouris. A number of electrical apparatus which are used in the work are described, and other electrical information is given. Besides this, the volume contains details of numerous applications of meteorology to viniculture and agriculture, and tables indicating the influence of climate on mortality; and a very curious chapter giving the results of the chemical and microscopical analyses of air and water, illustrated by numerous engravings.

## Underground Work in Chicago.

According to latest reports from Chicago, wires are going under ground there at a rapid rate, considering that most of the work of taking them down can only be done on Sunday, when there is little traffic in the business part of the city. Dearborn street was cleared on both sides from Madison street to the river, a distance of 2,000 feet, a few days ago. All the poles have been taken down in Wabash avenue from Monroe street to the river, 2,500 feet; on the west side of Clark street, from the bridge to Madison street, 2,000 feet; on the south side of Water street, 4,000 feet, and on Michigan avenue as far as Lake street, 1,400 feet. The west side of Market street has been cleared from Van Buren street to the river, a distance of 4,000 feet, and many preparations are being made to clear Randolph and other streets. City Electrician Barrett expects to see all the wires north of Van Buren street removed within three months, and all north of Twelfth street before the season is over. The district north of Twelfth street is about one and one-third miles long and three-fifths of a mile wide, and includes the business centre of Chicago. The work of burying the wires is also being carried on on the West Side. The telephone company has taken down its wires on Lake street, Michigan avenue and Fifth avenue, and is busily engaged placing the wires in its own conduits. The conduit company strings the wires for electric lighting and private wires and tickers, but the large telegraph and telephone companies are putting in their own conduits.

## Insulating Overhead Wires.

BY DAVID BROOKS.

An experience of forty years in the manufacture of insulators for telegraph lines should enable one to know something of the subject, though that does not necessarily follow. For the past twenty years I have made the matter of a perfect insulator in rain and fog, a study, and the present remarks will embrace the results of these investigations.

The first insulator I ever saw was in October, 1845, coming from Rochester to Albany on the Erie Canal. The New York Central Railway was then in course of construction and some portions in operation. In many places it ran parallel with the canal. Upon the line of the railway I noticed the first telegraph poles having a cross-arm with two insulators, but no wires. The line of telegraph was then in process of construction. In the late edition of Mr. Reid's "Telegraph in America," there is a good representation of that insulator, Fig. 1.

When in Rochester I engaged with Henry O'Reilly to come to Pennsylvania and assist him in the construction of telegraph lines. He was to write me when I should be needed, and I received due notice to come to Philadelphia, where I arrived on the 25th of November, 1845. After staying with Mr. O'Reilly in the city a few days, I proceeded to Lancaster, and found he had constructed a line between Lancaster and Harrisburg with one copper wire. The insulation consisted of a turned walnut pin two inches in diameter inserted in an auger hole; on the end of this pin was wound a strip of oil-cloth, and the copper wire was made to take one or two turns over the cloth. A representation of this fixture is shown in Fig. 2, from the same book. The first message passed over this line Dec. 25, 1845. We could not work it except in favorable weather. In rain all operations ceased; besides, the copper wire broke as often as twice a day. In the following spring I removed the wire, took it to Philadelphia and sold it for old copper. During the following summer we constructed a line between Lancaster and Philadelphia, and used a three-ply twisted iron wire with an insulator, shown by Fig. 3 (from Reid). This insulator broke so often we were obliged to abandon it, and in its place used the insulator shown in Fig. 4. Carpenters set a ladder by the side of the pole, went to the top and mortised out a trough or groove to admit this glass block, which carried the wire in the slot shown, and over the whole there was nailed a wood cap or cover to protect the insulator from rain. This last insulation was used from Philadelphia to Pittsburgh, but the ground being very uneven, the wire would get out of the groove and rest upon the pole or the cap wherever the pole stood in a hollow. We could not work the wire in rain. In the course of a year or two we put up the second wire from Philadelphia to Harrisburg, using a cross-arm insulator, as shown in Fig. 5. The hook was fastened in the glass by the use of brimstone. The brimstone would check or crack, absorb moisture and swell sufficient to split the glass, and the hooks were continually falling out. Here was my first attempt to remedy this difficulty: It was to mold the glass into an iron shield and insert the hook in the centre while the glass was in a molten state. The hook was very securely fastened in the glass, but the iron and glass did not shrink and expand together. The glass became full of cracks or fractures, which admitted moisture between the hook and iron shield. I soon got the credit of making the poorest insulator that ever existed. The difficulty was in a measure overcome by taking the wire out of the hook and suspending it from the hook by tarred rope. We went on making these insu-

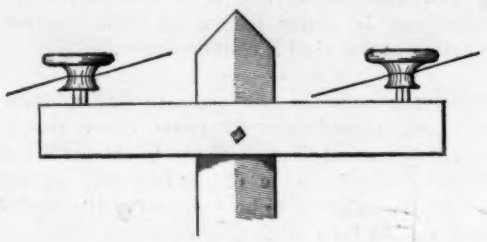


FIG. 1.

lators, and improved them to some extent by immersing them in hot spermaceti.

While this operation was going on, I came across a block or cake of paraffin, which was then a substance brought to notice as one of the results of the discovery of oil in Western Pennsylvania. There was no intention on my part to go into the manufacture of an insulator, but

FIG. 2.

FIG. 3.

I desired some means to so improve it as to make it fit a hole bored in the cross-arm, and at the same time accomplish the purpose of insulation. Finding that glass could not be molded into an iron shield and the hook be inserted in the glass while the latter was in a molten state, without the glass becoming full of fractures that would admit moisture, I had the glass cast separately in a mold, fast-

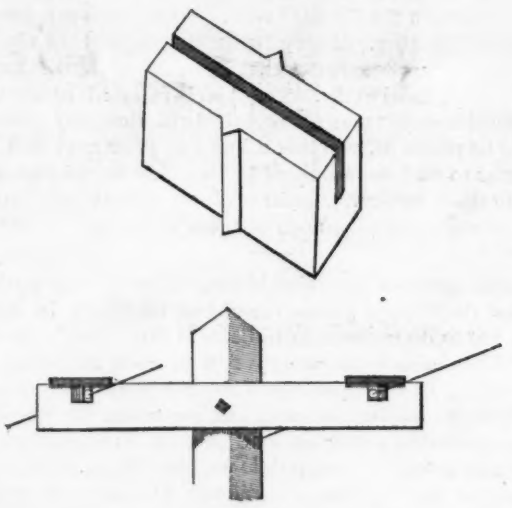


FIG. 4.

ened the hook into the glass with sulphur, and the glass into the iron shield by the same means; and in that manner I obtained a very perfect insulator. In the construction of new lines we used this insulator altogether, and experienced no difficulty in the most protracted wet weather. We put up two new wires from Pittsburgh to Reading, and there connected with two wires of the

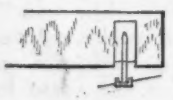


FIG. 5.

American Telegraph Company, insulated in the same manner to New York, and these wires were worked from New York to Pittsburgh at full speed in the hardest rains, when the wires of the American lines could be worked from New York to Washington only by the use of repeaters at Philadelphia. The working of these wires, Nos. 12 and 20, gave a reputation to the insulators that soon brought them into demand in other places. Through the agency of L. G. Tillotson & Co., a great many were sent to South America, Newfoundland and other foreign countries. Meantime, I had obtained a patent on the use of paraffin for insulating purposes, and the insulator became known as the "Brooks Paraffin Insulator."

Experimenting with paraffin, I found its notable feature to be its repellance of moisture. You cannot produce a wet surface upon it. The moisture will gather itself into detached and isolated globules. Other bodies possess this property, but not in so marked a degree. In many of the restaurants there are water decanters, and on the inner surface about the neck of these bottles, you will notice the water in detached and isolated globules. Knowing that the outer surface of the glass of a bottle cast in a mold is nothing like as smooth as the inner surface which comes in contact with nothing but the air in the process of blowing, I found by experiment that the inner surface of a bottle possessed great insulating properties, and I at once went to work, and had the glass parts so made that they could be used to great advantage in the iron shield, and that is the basis now of the Brooks insulator.

In 1867 I resigned my position as superintendent of the telegraph lines at Philadelphia, and gave my whole attention to the manufacture of insulators. I first took a trip to Europe, to see what was being done in that line in the old countries.

(TO BE CONTINUED.)

## Suits to Annul Patents.

Two reports by the minority of the Judiciary Committee upon the resolution submitted to that committee inquiring into the power of the government to institute suit at the instance of persons or corporations to annul patents were presented to the House of Representatives on April 13. The first report, which is signed by Messrs. Parker, E. B. Taylor, Hepburn and Caswell, after an exhaustive review of precedents, arrives at the following conclusions:

I. That the authority to cancel or annul a patent for an invention or discovery in a suit between private parties on the ground that the same was obtained by fraudulent collusion with an officer of the government or surreptitiously by or upon false suggestion does not exist.

II. That the public interests require that authority should exist in the government under proper restrictions to bring suit in the name of the United States to repeal and annul any such patent so obtained.

III. That under the statutes and decisions of the United States it is a matter of grave doubt whether authority now exists permitting a suit by the United States to annul a patent obtained as above stated, which doubt can only be determined by a decision of the court of last resort.

IV. That in case it shall be authoritatively decided that the right to bring suit for the cancellation of a patent claimed to have been obtained by fraudulent collusion with an officer of the government or surreptitiously by or upon false suggestion now rests with an officer of the government acting upon his own motion, or on the instance of another according to his judgment or at his pleasure to attack, in the name and at the expense of the United States, any patent now in life, or such as may at any time exist, with no restraints or limitations except such as shall appertain to judicial proceedings after the suit is commenced—it is a power and responsibitity that Congress should place, define and restrict.

V. That in case it shall be decided that no authority exists on the part of any officer or department of the government to institute such suit it is equally the duty of Congress to establish and limit such power.

This minority recommends the enactment of a bill conferring the necessary power upon the Attorney-General to bring a suit at the request of the Secretary of the Interior, in which no issue shall be litigated that can be determined in a private suit. Messrs. Ranney and J. W. Stewart unite in a second minority report, holding that there is no authority for a suit in the name of the United States brought for the purpose of vacating a patent for an invention except when it is based upon a state of facts which cannot be regarded by the court and made available in an infringement suit, and that in no case can the name of the government be properly lent to a suit in the interest only of private parties. It is a question which admits of grave doubt, they say, whether, in the absence of any statute providing for it, such a suit can be brought and maintained at all. The question cannot be regarded as decided by the United States Supreme Court, and the decisions in the Circuit Courts are conflicting on that point. But the better doctrine seems to be that a patent for an invention may be vacated in a suit brought by the government in the interest of the general public when obtained surreptitiously or by fraud. So far as this goes, and to this extent only, these gentlemen concur in the report of the majority, and join in the report of the minority except so far as the same is qualified by what is said above.

## Winding for Dynamos.

*To the Editor of The Electrical World:*

SIR: In a dynamo used for arc lighting, the wire of the armature and field are respectively, say Nos. 18 and 16. The same machine for incandescent lighting would require to be wound with what numbers of wire? And the same machine used for electro-plating would require what numbers? Could you give the relative or proportionate ratio of the current, as to volts and ampères, in each case? C. E. A.

CRAWFORDSVILLE, Ind.

ANSWER.—The size of wire on the armature depends principally upon the current which the machine is required to generate. The size of wire on the field depends upon the kind of machine, whether series, shunt or compound. No universal rule can be laid down, as evidently the sizes depend entirely on the type of machine and upon the work which it is designed for. Our articles on the winding of field magnets, by Mr. Carl Hering, will give you much valuable information on this point.—EDS. E. W.

### The Cut in Cable Rates.

The decision of the United Cable Companies to precipitate a rate war by a wholesale cut of the old tariff was made known officially in Wall street on April 19, the new rates being 12½ cents for general business, and 6 cents for news. The following statement from a high authority was circulated in Stock Exchange houses and telegraphed to out-of-town customers over many special wires, which said :

"The cut was made possible only by the Western Union Telegraph Company agreeing to give up its land tolls. By this action the Western Union will share in the cable business only to the extent of its interest in the cable pool, which is 22½ per cent. of the total receipts. This cut is a direct blow at Baltimore & Ohio, as well as at the Mackay-Bennett Cable. The latter cannot meet the cut to Western points unless the Baltimore & Ohio stands in with it on the land tolls. The reason the Mackay-Bennett Company has not met the cut is because it is waiting for the Baltimore & Ohio's answer on this point. The reason why the cable companies have united to try to wipe out the Commercial Company is, first, it would not join the pool; second, it last year, outside of the pool, took over $1,000,000 of cable business, and third, it has avowed its intention of staying out of the pool. The cut affects all points covered by rival lines of the Western Union."

### Steno-Telegraphy.

Among the various methods of increasing the number of words which can be transmitted over a telegraph line, that in which stenography is called into play is one of the most interesting. It is many years since Michela first brought out the system that has just been improved and put into practical shape by M. Cassagnes. The stenographic system employed subdivides words into their phonetic elements, which are represented graphically by various combinations of a very small number of different signs.

The apparatus consists of a key-board at one end of the line and at the other a series of type levers, upon which the various stenographic characters are carried. By pressing a key at the sending end, the corresponding lever is raised at the receiving end, and the characters are printed upon a roll of paper which advances a step after each imprint of one or more signs, according to the number of keys depressed at a time. The method employed being a phonetic one, it is applicable to any language. The apparatus mentioned above for carrying out this system is one the essential features of which our readers are already familiar with, as it resembles the Delany and Callahan system of synchronous multiplex telegraphy, recently described by us.

The general arrangement of the receiving station is shown in Fig. 1. Each sector $D'$ of the phonic wheel is connected with one of the polarized relays $R_3$, $R_4$, etc., which close the circuits of the electro-magnets $e\ e\ e$ through battery $P_3'$. The printer $P$ in Fig. 1 is shown in perspective in Fig. 2, and consists of 20 printing levers which carry the stenographic signs. As each electro-magnet is energized it attracts its hinged armature from below and pushes up its printing lever. At the transmitting station the 20 keys on the board are connected to the sectors of the phonic wheel corresponding to those of the receiving station, so that the pressing of a key causes the corresponding sign to be printed. The polarized relay is shown in Fig. 3.

With this much by way of explanation, the working of the apparatus for the production of signs will easily be understood.

A stenographic line corresponds to the depression of not more than twelve keys. The last of the relays is not connected to a printing electro, but to the electro-magnet $M\ M$, Fig. 2. The movement of the armature of the latter effects the movement of the roll of paper, so that after every revolution of the phonic wheel the paper is advanced a step, on receiving its imprint of signs. After each movement the instrument is in condition to receive another impression.

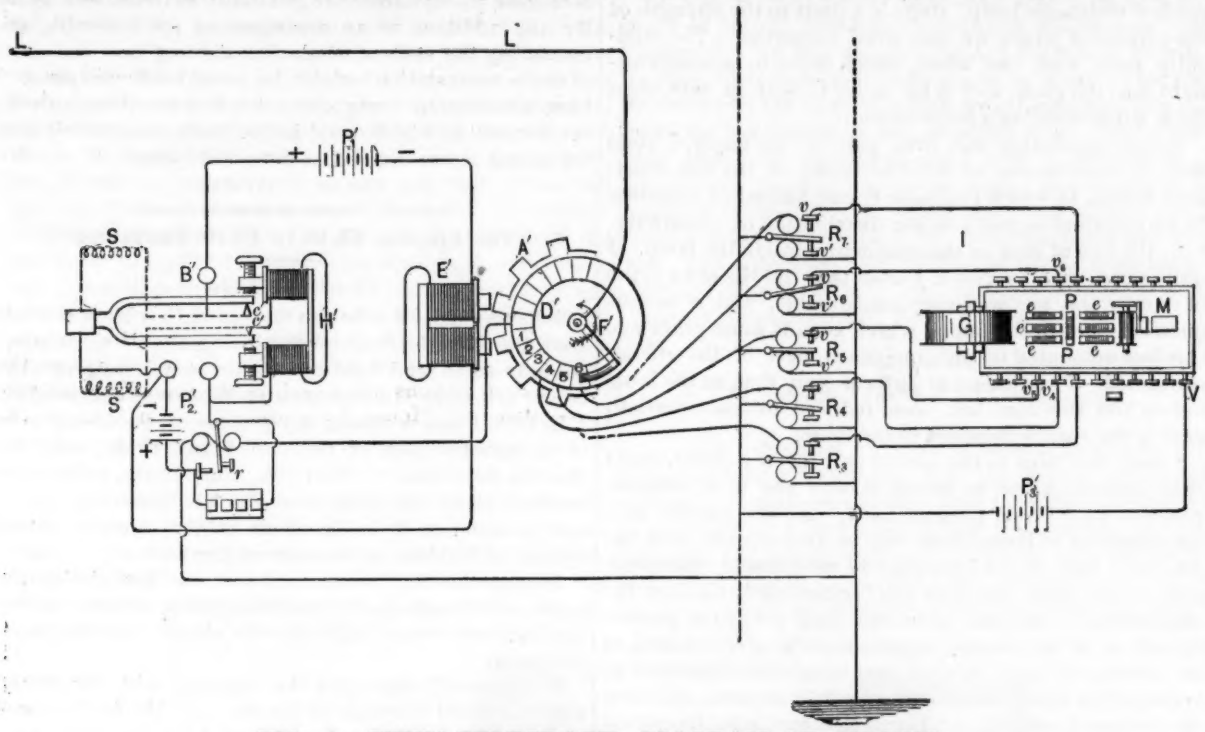



FIG. 1.—STENO-TELEGRAPH—DIAGRAM OF CIRCUIT.

The main object of this system is to transmit a given number of words at the greatest possible speed, and to reduce the number of electrical impulses required for signaling. As a result of the tests in France it is found that the maximum speed there is nine stenographic lines per second, which would correspond theoretically to 540 words per minute on short lines and to 320 on long ones. Of course a single operator would not transmit that number of words individually, but perforators are employed, as in the Wheatstone system, and with the slips fed in at the required speed 400 words per minute have been actually attained. The method also permits of the transmission of the matter into various circuits at the same time.

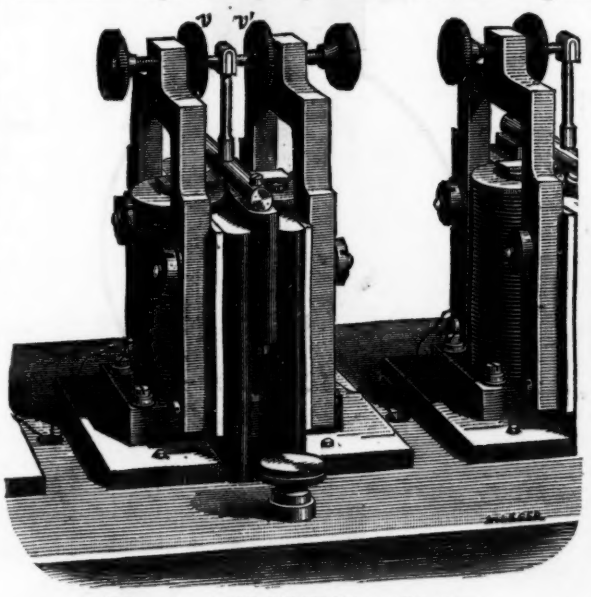



FIG. 3.—POLARIZED RELAY.

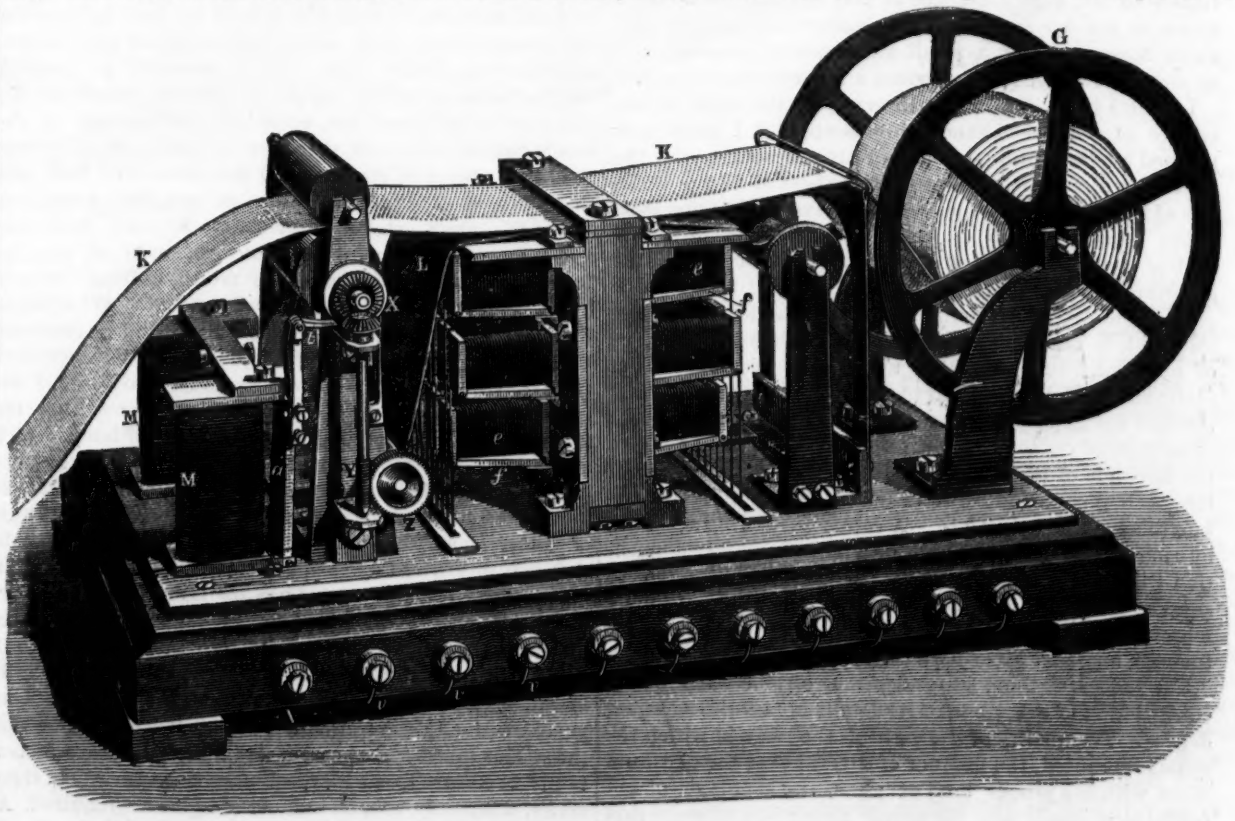



FIG. 2.—THE STENO-TELEGRAPH MACHINE.

It would appear, says *La Lumière Electrique*, that it requires only the short time of two weeks to learn to decipher the stenographic signals ; but a longer time is necessary to acquire dexterity at the key-board. At the latter, 150 words can be transmitted after five months' practice, and 200 after eight months.

### Electric Lighting on Pacific Coast Steamships.

Quite a number of the principal steamboats of the Pacific Coast Steamship Company, plying between San Francisco and ports in Southern and Northern California and up to Oregon and Washington Territory, are lighted by electricity. In fact, it is claimed that the "Columbia" of this line was the first steamer in the world to be so lighted, she having been equipped with the Edison system in 1880. This experimental plant has given excellent satisfaction ever since, as demonstrated by the fact that each new vessel since then has also been equipped with the electric light. The "Queen of the Pacific" has the Edison system, and the "State of California" has arc lights of the Brush system.

The newest, most elaborately fitted and best lighted vessel of the line, however, is the "Santa Rosa," which runs from San Francisco to San Diego, Cal. The "Santa Rosa" has 602 Edison lights. Both a day and a night circuit are run. There are 185 lights on the day circuit and 417 on the night circuit. All the lamps are 110 volts. The forward saloon is lighted by 12 clusters, each of six 16 c. p. lamps, while the after saloon has 9 clusters each of 2 lamps. These clusters are covered by shell opal globes, and the effect is all that could be desired. The lights burn steadily and brightly, are exceedingly pleasant to the eye, and evoke profuse praise from all who see them. In addition to the clusters in the cabin, there are 7 clusters in the "Social Hall," or general sitting room on the upper deck. One of these has 16 lamps, another 8, another 6 and the four others 3 each, all of 16 c.p. There are seventy-eight 10 c. p. lamps in the staterooms and sixteen 32 c. p. lights in the officer's rooms. Outside there are thirteen 16 c. p. lamps on the upper deck and 26 on the main deck. For side lights two 50 c. p. lamps are used on each side, and for a headlight three 50 c. p. lamps. There are four 50 c. p. reflecting lights for docking, one headlight of three 50 c. p. lamps for looking for anchor and one 50 c. p. gangway light ; so that electricity is the only luminant used on the steamer.

When the plant was originally put in the "Santa Rosa," three years ago, there were only 467 lamps and a 300-light dynamo. Since then a second dynamo of 260 lights has been added and the number of lights has been increased to 602, as stated above. Mr. R. A. Simon is the electrician on the "Santa Rosa," and the very satisfactory manner in which the plant is run demonstrates his eminent fitness for the position.

Electric lighting on shipboard is not confined, so far as the Pacific Coast is concerned, to the vessels of the Pacific Coast Steamship Company. A number of ocean steamers, coast steamers and ferry boats are also lighted by electricity, several of them having incandescent plants of about 300 lights and some few arc plants. It will, therefore, be seen that the Far West is keeping well up in the march of electrical progress, and is likely to more than hold its own.

## Electrical Lighting by Means of Low Resistance Glow Lamps.*

BY ALEXANDER BERNSTEIN.

(*Continued.*)

It has often been noticed that a blue flame makes its appearance upon the positive platinum when the carbon is raised to a high state of incandescence. As no explanation of the production of this blue flame has as yet been given, I beg leave to insert here a few words respecting the most probable cause of it.

All platinum, when cold, occludes a large quantity of oxygen, which is given off again when the platinum becomes heated. The black, sooty deposit of carbon on the positive platinum is just in a condition to combine readily with the oxygen, and both together form the blue flame. While the lamp is on the vacuum pump this flame may often be seen to travel up and down the platinum wire, always appearing where occluded oxygen is set free. If the pumping continues without the current being increased, the quantity of free oxygen is soon consumed, and the blue flame disappears, but reappears again if the temperature of the platinum is increased by increasing the current. Just in the same manner finished lamps will, under all normal conditions, show no blue flame, but will do so if an excessive current is passed through the lamp. In this case a blue flame is sometimes seen on the negative platinum as well. This occurs because particles of carbon find their way to the negative platinum and are oxidized there in the same manner. As the spectrum of the blue flame has been observed by Messrs. Liveing and Dewar to be that of carbonic oxide, it seems so much the more probable that the explanation here given is correct.

We have now to notice another effect of the vacuum tube. When lamps are made for very high difference of potential and corresponding small current, there seems to be a very strong tendency of the current to leap across from one terminal to another, thereby short-circuiting the lamp, destroying the filament and fusing the platinum wires. This tendency is very strong when the current is turned on suddenly, as the carbon, being cold, then offers the highest resistance to the passage of the current.

One of the conditions which it is desirable to observe in respect to a practicable lamp is that a certain excess of current such as is liable to occur in installations must not be able to destroy the lamp; and in this respect it is certain that the lamp with a thick filament is far superior to the lamp with a thin filament.

Turning to another point of practical importance, we notice that lamps with fine filaments are exceedingly subject to flickering as soon as the strength of the current varies but slightly. Variations of this kind may have their cause in irregular motive power, in slipping of a belt, or in a dynamo which is not perfectly balanced either mechanically or electrically. Such flickering will be noticed in a great many installations with small-current lamps, and is exceedingly disagreeable to the eye. Now, with a large hollow carbon used in the lamp, which I shall presently describe, the interior is always at a higher temperature than the exterior, and serves as a reservoir of heat, which allows for certain variations in the current, without any effect on the eyes as regards the light.

How are we, then, to obviate these difficulties appearing in the lamp? If the thin filament does not promise much durability, and is disadvantageous in other points mentioned—if the high difference of potential proves to be a factor in the destruction of the lamp—we must employ thick filaments and a small difference of potential; or, in other words, we must produce a low-resistance lamp.

I think I have sufficiently shown you the right of existence of a low-resistance glow-lamp, and I shall now proceed by describing the lamp which is before you, the form of which seems to be one of the best of all the varieties of low-resistance lamps which I have made since 1882.

The lamp which is shown in Fig. 2 consists of a glass bulb of oval shape, into the opposite ends of which the platinum wires are sealed. In this manner the glass is placed symmetrically round each wire, and is therefore less liable to crack when heated. The carbon has the form of a straight tube mounted upon short pieces of stout platinum, which are joined to the platinum wires passing through the glass by means of flat thin copper strips, bent upon themselves so as to form springs at right angles to the direction of the carbon. In this way all parts of the lamp can expand and contract without subjecting the carbon to any injurious strain. A cap of insulating material at each end of the glass bulb provides for proper connection with the conducting wires, which may be made to support the lamp; and this connection is made in such a manner as to prevent accidental contact of the manipulator with any part carrying a current.

The success of these lamps depends on the satisfactory construction of every one of its details in an almost equal degree. The quality of the carbon, the way in which the same is mounted, the manner of surrounding the platinum wires with the proper kind of glass, the avoidance of any mechanical strain, and the proper proportion of every part of the lamp, are all the results of tedious experiments, which were necessary in order to produce a satisfactory lamp. The electrical dimensions of the lamp are as follows: It requires a current of 9.75 ampères, thereby showing a difference of potential of 7 volts, and a hot resistance of about 0.7 ohm.

When speaking of the high-resistance lamp, I have mentioned that there seems to be a limit to the difference of potential which we can apply in each bulb. As regards the low-resistance lamp, there is a limit to the strength of the current of which we can avail ourselves. The difficulty rests with the wires, which have to be sealed air-tight into the glass, as it is far easier to seal in thin than thick wires carrying a large current.

Before concluding this first part of my paper, I shall have to mention one of the drawbacks of the low-resistance lamps, to which Professor Forbes has called attention in his excellent lectures on the distribution of electricity, viz., the loss of heat in the conductors inside the lamp. I quite agree with Professor Forbes that in the older types of lamps the loss was very considerable, and a serious question; but in the lamps which I made some years ago this loss amounted to only one-tenth part of the energy consumed. I am happy to inform you that in the lamp before you this loss has been reduced to one-twentieth part of the energy required in the lamp.

I shall now turn to the second part of my paper, and I shall consider it best to attack at once the most difficult problem which can present itself, viz., the supply of a large number of lamps from one central station, with the condition that all the lamps can be used entirely independent of each other, and with the further condition that the expenditure of mechanical energy shall always be proportioned, or, at all events, approximately proportioned, to the number of lights in use. Our imaginary plant is to be arranged for 6,000 lamps, requiring 9.75 ampères, and upon the average 6 volts each. Let us first look into the central station and consider its requirements. We shall settle

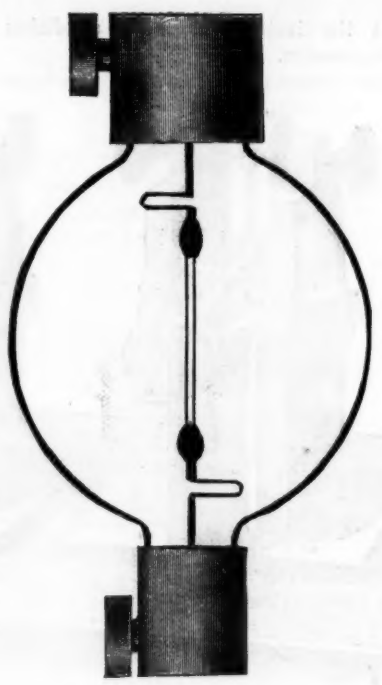


FIG. 2.

upon the use of a dynamo which with a current of 10 ampères is capable of producing an E. M. F. of 2,000 volts—a kind of dynamo which was first applied by Mr. Brush, and which is already extensively used for arc lighting, or for a combination of arc lights with groups of glow lamps, several of the latter being always arranged in parallel. But the lamps of which I spoke at greater length in the first part of my paper are made for the passage of the whole current, and will therefore be arranged in series, one being placed in the line after the other. In this case there will be more than 300 lamps on each line; let us say 300. We shall, therefore, require 20 such dynamos, and one or two spare machines in case of repairs. These 20 dynamos may be driven from shafting, or each by a separate steam engine. There are 20 separate lines proceeding from the central station, and as the main condition of our system is that the current on every line must always be kept constant, we must provide for the regulation of each dynamo in such a manner that the E. M. F. always corresponds to the number of lamps which are in use. This regulation can be effected by automatic devices, or may be done by hand in adjusting the magnetic field or the speed of the dynamo. An ampère-meter which is placed in every circuit will indicate whether this condition is fulfilled, and a voltmeter connected with the terminals of each circuit will inform us how many lamps are used on each line at any time. A registering voltmeter placed in the same manner would be another useful addition. The central station, furthermore, contains a switch-board, which allows any one of the circuits to be connected with any one of the dynamos. If we presume that the station is to supply current day and night, it would certainly be absurd to run all the dynamos constantly at those times, when only a small number of lights are required. At daytime, then, I should propose to loop several circuits together, and if the total number of lamps is sufficiently low, all the 20 circuits might be looped in a single one, so that only one dynamo need be kept running. By means of an auxiliary line of lamps in the central station, dynamos and circuit may be switched in and out without any sudden change in the conditions of either. The system of working would then be that in the afternoon one dynamo after the other is switched into its respective circuit, the requirements of which can always be ascertained on the voltmeter of this circuit. If the consumption of light decreases, the dynamos are gradually switched out again. By the addition of an arrangement for observing and measuring the state of insulation of every line, the outfit of the central station might be considered complete. I have not mentioned any apparatus in connection with the central station which could not be easily constructed with the means at our disposal at the present time.

(TO BE CONTINUED.)

* A paper read before the Society of Telegraph Engineers and Electricians.

## The Electric Light in Photo-Engraving.

BY LEO BOCK, JR.

Believing myself to be the first one in New York city who used the electric light for producing photo-engravings, I am induced to send a little historical sketch suggested by a recent article in THE ELECTRICAL WORLD on this subject.

In 1873, I was working my process of photo-engraving in the establishment of the late Frank Leslie, publisher, then on the corner of Pearl and Elm streets, reproducing printing plates for him from foreign illustrated papers, and, in order to be independent of the sunlight, he sent for one of Wilde's machines from England.

The machine had two armatures, one for plating purposes, which was used for electrotyping during the day, and the other one at night for the electric light for photographing.

It happened very often that the mail with the foreign papers arrived very late in the day, and Mr. Leslie wanted to have a particular picture copied for his paper which was to be issued the next day.

In such a case, the picture was photographed about 7 P. M., the photo-engraved plate being made with the use of the electric light. The plaster mold of the same was cast in type metal within three hours, touched up, and at 12 P. M. put in the press, which was waiting for the same.

The following day Frank Leslie's paper would be circulated with reproductions from the illustrated European papers that had arrived only the evening before, and we were thus ahead of all other publishers.

We exhibited the electric light (Serrin focusing lamp) one night on the roof of a building at the corner of Broadway and Pearl street, by running naked copper wire, insulated as best we could, from the dynamo on Elm street, and you may find some account of it in the papers of that date. Mr. Frank Leslie was a great advocate of the electric light to be put on ocean steamers to prevent collisions in foggy weather, but, unfortunately, he was ahead of his time, and the machines and lamps were not as perfect as they now are.

## The Telephone in the State of New York.

Certain resolutions of Senator Coggeshall demanding information of the telephone companies of the State have passed the New York Senate without opposition. They read as follows:

*Resolved*, That the Metropolitan Telephone Company of New York and each and every other telephone company organized or doing business in any and all of the cities, towns and villages of this State be and they are each hereby required within seven days after the adoption of this resolution and the service of a copy of the same upon the President or any officer thereof to report to this Senate under oath of one of its general officers or managers a statement showing:

I. The amount of its original capital.

II. If increased, when and how and in what manner.

III. The present nominal capital, and whether the whole or any part of the stock thereof is owned or controlled by foreign corporations, and if so, what proportion and how much ownership was acquired and the consideration paid therefor.

IV. What surplus of earnings it now has and how invested.

V. What dividends were declared and paid on its stock in 1885, and what were its gross and net earnings for that year.

VI. The actual first cost of each telephone and the gross and net rentals received therefrom.

VII. What royalty or license fee, if any, is paid by said company, and to whom paid and how paid and under what agreement.

VIII. The number of telephones it now has in use by its subscribers and how much is paid therefor, respectively, the average rate per month paid therefor by each subscriber and the aggregate sum received during the year 1885 from any and all sources for such service.

The Clerk of the Senate is hereby required and directed to forthwith serve a copy of this resolution upon each and every telephone company herein mentioned and referred to, organized and doing business within this State.

Senator Reilly's bill fixing telephone charges in New York and Brooklyn at $7.50 per month, and $3 in other cities of more than 100,000 inhabitants, has been ordered to the first Committee of the Whole in the Senate.

**The American Electric Time Company,** of New York City, has been incorporated with a capital of $100,000.

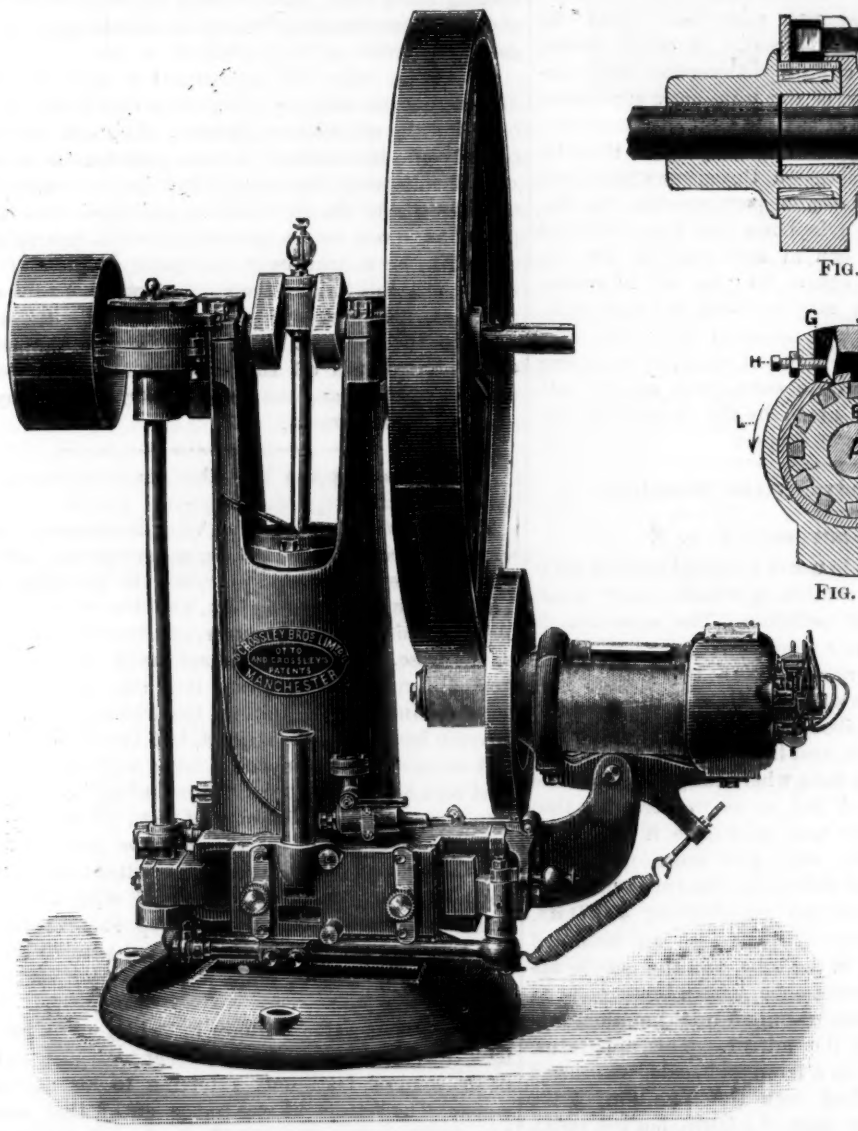
### Electrical Experiments and Measurements Abroad.

Electricians will be interested to learn that the municipality of Paris have just granted a site for the erection of a National Electrical Laboratory, to which the funds left available after the close of the International Electrical Exhibition of 1881, amounting to over $60,000, will be applied. Many problems of vast scientific interest have remained unsolved in consequence of the expense attending the experiments and the costly nature of the instruments required. Henceforth these obstacles will be removed, thanks to the excellent and patriotic idea of M. Cochery, late Postmaster General. We may add that at the last meeting of the Berlin Society of Electricians, Professor Rühlman proposed that the German Government be petitioned to legally define the electrical units now in use, and to establish an office for electric measurements where a legal standard of resistance should be kept, and used as a basis for standardizing resistances supplied to the public. The proposal was seconded by Professor Foerster and Dr. Werner Siemens, and unanimously adopted.

### A Compact Electric Lighting Plant.

The demand for domestic electric lighting has already given rise to a number of small engines of various types which all have their peculiar merits Recently, however, an interesting form of motor and dynamo combined has been designed in England, and we illustrate it in the accompanying engraving. The motor is an Otto gas engine, of the vertical type, in which the slide works across the side of the combustion chamber, instead of at the end, while the side shaft is driven by a pair of screw-wheels. Running at 200 revolutions per minute the engine gives 1.3 indicated horse-power and .98 brake horse-power. The piston measures 4½ inches in diameter and has a stroke of 6 inches.

The dynamo is of the Jones pattern. It runs at 2,000 revolutions per minute and will feed from 6 to 8 lamps of 20 candle-power each. It is driven by a friction pulley which runs in contact with the fly-wheel of the engine. The requisite pressure between the two is obtained by the device of pivoting the dynamo to a bracket on the engine frame, and drawing down the end of it, nearest to the commutator, by means of a screw which tightens a strong helical spring.




COMBINED DYNAMO AND GAS ENGINE.

### Electric Church Bells.

Electric bells have now been adapted in England for use in church towers, alarm turrets, and other similar positions. The gong is the ordinary church bell pattern, and the coil, armature and hammer are all contained inside it, and thus there is a very efficient protection against dust, etc. The connections are ingeniously arranged so that very secure attachments can be made. The example which has been brought under our notice is, so far as we are aware, the largest electric bell in effect which has yet been made. It weighs 60 lbs., and the size of the dome is equivalent to an ordinary hemispherical dome of 22 in.

It will be understood that with this form of bell the work of the old-established bell-ringer will be very much lightened. All that will be necessary for him to do will be to press a key at regular intervals, or a small motor could be driven by the battery, which would automatically complete the bell circuit at the requisite rate. With bells of this type, one bell-ringer could ring a whole peal by alternately pressing the proper keys. In addition to this application there are of course numerous others equally useful, as for instance bells for factories, foundries, ships, etc. The system has been introduced by the Woodhouse & Rawson Electric Supply Co., of Great Britain; 11 Queen Victoria Street, London, E. C., and is known as the Jensen.

### Telephone Troubles in Indianapolis.

A special dispatch of April 16 from Indianapolis says: It was announced yesterday that the Central Union Telephone Company would put into operation private telephone stations where those whose instruments had been removed and others might communicate with the remaining subscribers in connection with the Exchange. In view of the fact that the franchise of the company had been repealed, and that it was absolutely without right in the city, this alleged attempt to introduce a new feature of business aroused the indignation of the city officials, and a special meeting of the Council and Board of Aldermen was called for to-night to consider the situation. The Judiciary Committee reported a resolution directing the Telephone Company to remove all its poles and wires in the city within 14 days, and, in the event they are not so removed, then the Street Commissioner is directed to cut them down. This resolution passed the Council and Board of Aldermen with only one dissenting vote in each body. A futile effort was made to stay the action by showing that this removal would practically destroy the city's fire-alarm telegraph system for 60 days, and cause an unnecessary outlay of $5,000. The temper of the Councils was to inflict as much damage as possible on the company, and especially not to permit it to realize anything from its poles and wires by disposing of them to the company that may be granted a franchise to operate in its abandoned field.

The company has had another piece of bad luck to-day. Some days ago County Auditor Adams called the attention of the telephone company to the apparent discrepancy between the sworn value of its plant as reported to the Court in the recent litigation, and the return made for taxation, and he gave notice that this morning he should correct the tax duplicate so that the amounts would more nearly correspond. An intimation coming to the ears of the Auditor that an effort would be made to enjoin him from doing this, he did not wait until this morning, but yesterday afternoon increased the assessment from $16,000 to $50,000, just an hour before the Court issued a temporary injunction against the increase being made. In the application for an injunction the company claims that the Auditor has no right to make the increase, and that by the proposed alteration of the duplicate a cloud will be placed on the company's title to its property, and it will be subjected to irremediable wrong and injury. The company paid $176.15 in taxes in 1884, and $134.51 in 1885.

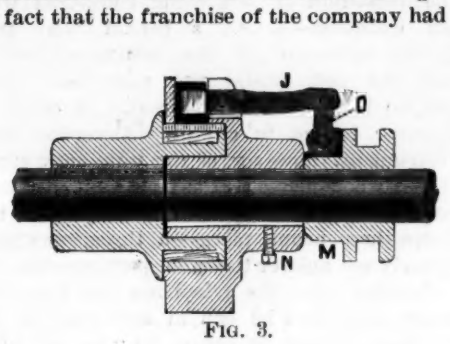



FIG. 3.

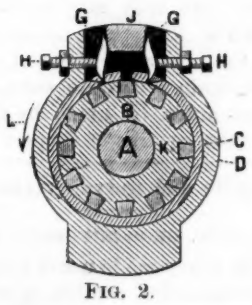



FIG. 2.

### A Novel Friction Clutch for Electric Lighting.

Where a number of machines are driven from the same source of power, it is highly desirable that each one, or any number of them, should be independent of the others. In electric lighting stations especially, prudence requires that every machine should be independently controllable even when driven from the same countershaft, so that the throwing in or out of service may be performed in the shortest time possible. To accomplish this the Link-Belt Machinery Company, of Chicago, have designed a novel form of friction clutch pulley which embraces some valuable features. The clutch-pulley is shown in perspective in Fig 1, and its construction and operation will be clearly understood on reference to Figs. 2 and 3.

The driving is effected by the friction between the hardened steel ring *C*, and the wood-filled hub *B*. The case or hub *D* is keyed to the shaft and has the set screws *H H* passing through it, which act as fulcrums to the levers *G G*. These levers, when pressed by the wedge end of the lever *J*, clasp the hardened ring *C* and tighten its grip on the hub *B*, so that the latter drives the pulley. By referring to Fig. 3 it will be seen that this action is accomplished by sliding forward the grooved collar *M*, which raises the outer end of the lever *J*, and forces the wedge end down upon the oscillating levers *G G*. The movement of the grooved collar *M* is controlled by means of a shipping lever, as shown in the large engraving. When this clutch is engaged, the toggle *O* is thrown a little past the perpendicular, thus forming a self-lock, so that there is no danger of the clutch becoming relaxed, and it also relieves the clutch from any end thrust. The wood filling of the hub absorbs oil, and thus lubricates the moving parts when the pulley is idle. When pressure is applied, however, the oil is squeezed out and friction is greatly increased, so that the clutch grips tightly when the lever is moved.

This device evidently makes it possible to drive each dynamo independently, and its simplicity makes it little liable to get out of order.

We may add these clutches are made in twenty-one sizes, and range in power from 8 horse-power at fifty revolutions per minute to the largest sizes, which will transmit 1,000 horse-power at 500 revolutions per minute.

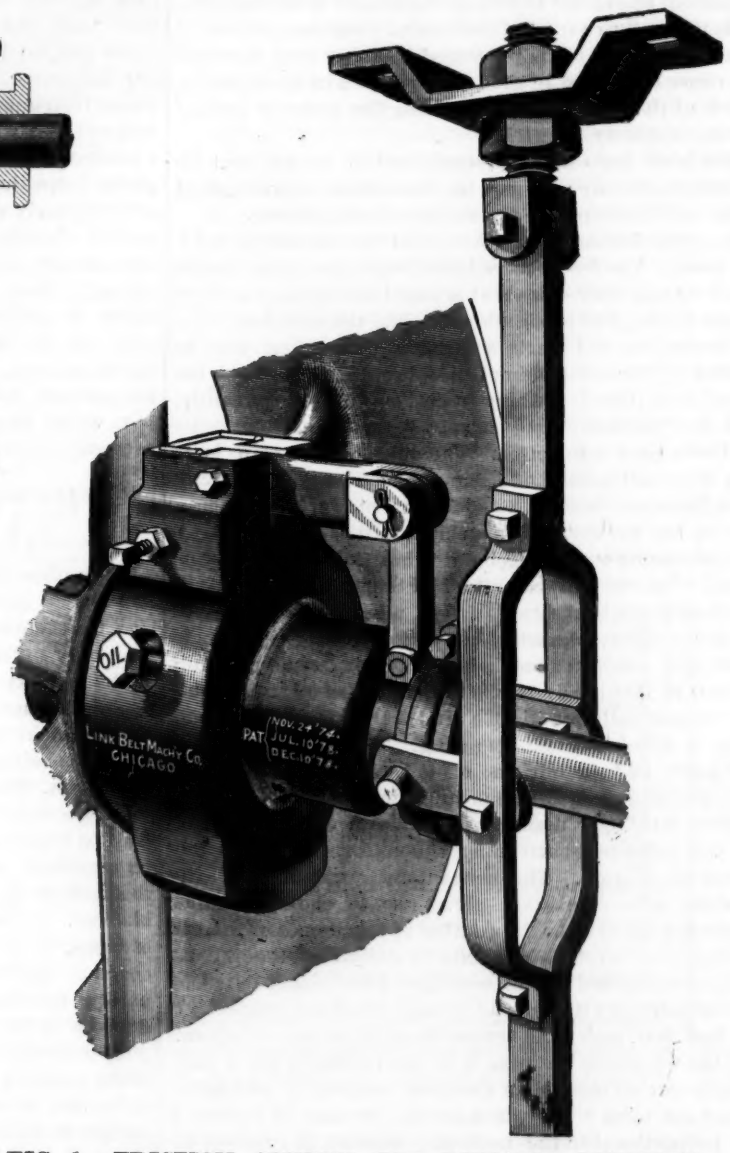



FIG 1.—FRICTION CLUTCH FOR DYNAMO RUNNING.

## The Automatic Telephone Toll Collecting System.

BY DR. WELLINGTON ADAMS, ST. LOUIS, MO.

I herewith give a more extended description of the new automatic telephone toll system, described in THE ELECTRICAL WORLD of April 17.

This system, operated in this city by the Missouri Pan-Electric Telephone Company, is the invention of Messrs. Rose and Rein, and the patent is owned and controlled by Mr. Charles Hoyle, No. 417 Pine street.

As manager of the Missouri Pan-Electric Telephone Company, I must say that the new system is a happy hit and a perfect commercial success. We have over two hundred toll telephones up in St. Louis, and they work admirably, causing us no trouble save what is common to all telephone systems.

In order to secure the central office to ask for a connection, a "nickel" must first be pushed into the slot provided. The hand-phone is then taken down, which act turns the magneto-generator and sends a current to line, which causes the proper drop to fall at the central office. The operator's attention having thus been secured, the number desired may be called for and the connection made. On replacing the hand-phone, after the conversation is finished, the nickel drops into the sheet-iron cash box, securely locked below, and the magneto-generator being again turned, a second current is sent to line, which drops the "clearing out" drop and notifies the operator that the conversation is completed. Until the hand-phone is replaced, the nickel is held in suspension in the call-box, and is under the control of the central operator, so that, if the number called for is "engaged," the central operator may cause the nickel to slide out upon the inclined tray to the left of the push button, providing the latter be pushed in simultaneously.

Thus is the pay exactly proportioned to the service: No connection, no pay; no pay, no connection—a principle of justice which the people are not slow to appreciate.

The slot is just large enough to admit the current nickel 5-cent piece. The 2-cent piece is too large; the 1-cent, 3-cent and silver half dime coins are too small and too light to operate the device, and so slip through into the cash-box without arranging the parts so that a connection can be effected. The device is not complicated, as might be imagined, and there is nothing to get out of order readily. It is not necessary that the coin should be clean in order to effect a good connection. The office of the coin is to open a circuit instead of closing one. The talking circuit is not interfered with. No additional magnets are necessary to the present telephone apparatus. The toll part is in combination with the generator box and is all self-contained, with the cash-box attached thereto, and it may be attached to the back-board of any telephone outfit. All the hooks and crooks which may be resorted to in order to evade the use of the nickel have been carefully guarded against, so that the system is not merely novel and unique, but commercially practicable and valuable. The whole thing is absolutely self-operating. There is no trouble of any kind, and in our use of it here we discover almost daily some new advantage peculiar to the system.

Every telephone manager is well aware of the difficulties and deficiencies attending the uniform arbitrary rate system of charges. The necessity of "calling off" after finishing a conversation gives rise to endless trouble. Under the toll system the number of telephones which can profitably be erected in a city is unlimited, the income being proportioned to the increased service demanded by each subscriber with each additional telephone erected. It is a fact that, under the present financial system of operating the telephone business, it is not profitable for a company to put up more than a certain number of telephones in any one town or city, because the increase in income is not proportional to the necessary increase in running expenses, and also because of the vast army of dead-heads who get their telephoning for nothing. The toll telephone can be introduced most profitably in hundreds of places where a telephone under the existing system cannot be placed—such as hotels, drug stores, saloons, etc. In such places a telephone is desired by the public in general, and no one individual wants to pay for the instrument for the accommodation of the public. In such places a public toll telephone can be introduced, and a revenue secured amounting to from fifty to five hundred dollars per year. No one person is required to bind himself to pay any definite amount, and the proprietor of the establishment is not required to attend to the collection of the tolls or the operation of the telephone.

With the toll system it is practical to adopt the principle of charging a minimum definite amount of rental for the introduction of a telephone and a toll for each connection—similar to the plan now in use in California—without necessitating an intricate system of book-keeping and a host of complex details, and without giving opportunity for endless disputes between the company and the subscriber. This definite rental—which may vary from thirty to fifty dollars per year—constitutes a fixed common amount which guarantees compensation to the telephone company for the expense of building the line and of "placing" the telephone, and the tolls for the connections pay the expenses of the "service" and are commensurate with and proportionate to the number of connections made. All money is collected in advance. There are no monthly bills and statements to be made out. Disputes between the telephone company and the subscriber cannot arise. The telephone company derives a much larger revenue and yet with less complaint on the part of the subscriber, because its revenue, instead of coming from a few heads of establishments, comes from the masses, deadheads being necessarily excluded. In fine, this automatic telephone toll collecting system constitutes an ideal basis for the financial management of the telephone business.

## Automatic Collection of Telephone Toll.

Last week we made incidental reference to the automatic apparatus in use at Bradford, England, for collecting telephone toll. An English contemporary says on this subject:

It is an "automatic call-box," which in some of its essentials is similar in its working to the automatic cigarette and post-card machines which have already become familiar objects at the various metropolitan railway stations. One of the difficulties hitherto experienced in the multiplication of public telephone call offices is that the amount of custom they attract is insufficient to pay for the cost of attendance. By making the working automatic this cost is avoided, and all difficulties as to the collection of the fees are obviated. An ordinary telephone apparatus is fixed in some convenient place, such as a cabman's shelter or the shop of a tradesman, but normally it is in the condition of not being connected with the telephone exchange—*i. e.*, a person who tried to ring up the exchange in the ordinary way would find that the bell would not ring, and that he could get no response to his appeal. In other words, the telephone is not in circuit. Alongside the telephone instrument, however, is the automatic apparatus, inclosed in a wooden case and having a slit like that over a tradesman's till. If the person wishing to use the telephone drops three penny pieces—a threepenny piece will unfortunately not answer the same purpose—into the slit, he will then find that the telephone has been switched into circuit, and that he can at once ring up the exchange. He may then, of course, be "put on" to whomsoever he pleases, and they may converse for three minutes. At the end of that time, or when the "ring off" signal is given, the person at the exchange, by reversing the current, can again sever the connection at the call-box, which must again be made by the deposit of the necessary threepenny worth of coppers.

## A Thermopile and Galvanometer Combined.*

BY PROF. GEORGE FORBES, F. R. S.

The author has lately made use of a special form of thermopile and galvanometer combined, which is very sensitive for the measurement of radiation. The apparatus is especially suitable for use as a line thermopile.

The first experiments were made with two half tubes, one of antimony, the other of bismuth, soldered together so as to make a short tube about 2 cm. external diameter, the walls being 2 mm. thick, and the length of tube about 2 or 2½ cm. The sides of the tube where the junction of the metals occurs was then filed flat, so as to present a thin wall to receive the radiation and to enable it to rise in temperature more rapidly, and also more uniformly throughout the thickness of this wall. This tube was lamp-blacked. A Thomson mirror and magnets (by J. White, of Glasgow), in its usual brass cell, but with an insulated coating, was then inserted in the tube, and the whole apparatus mounted inside a brass cube with a brass cone at one side to throw the radiations upon one junction, and with a circular hole facing the mirror. This apparatus, when properly adjusted with a lamp and scale, was found to be very sensitive. It had been the intention of the author to use a telescope in place of a lamp, but the radiations of the lamp were found to give rise to no inconvenience.

Let us compare the probable sensitiveness of this instrument, say, with a line-thermopile of the ordinary construction of 20 pairs, forming a line of the same length as the tube, the double length of a pair of antimony and bismuth in the line thermopile being equal to the circumference of the tube. Let $E$ be the E. M. F. of one junction, and let $R$ be the resistance of one pair in the line-thermopile, and let $R'$ be the resistance of the galvanometer used with the line-thermopile. The total resistance of the line-thermopile is 20 $R$, and that of the tubular one is $\frac{R}{20}$, and the currents in the line and tubular thermopiles respectively are $\frac{20\,E}{20\,R+R'}$ and $\frac{20\,E}{R}$. If the galvanometer were specially constructed to match the line-thermopile $R'$ would be made equal to 20 $R$, and the current would be $\frac{E}{2}$, or one-fortieth of the current in the tubular thermopile and galvanometer combined. Thus it would require forty turns of wire in the low resistance galvanometer, if these coils occupied the same space as the metal of the tubular thermopile, to equal the sensitiveness of the latter, and a larger number if it occupied a greater space. On the whole, it seems probable that by specially designing a galvanometer to match the line-thermopile the arrangement would be about as sensitive as the new instrument in the form hitherto described, but the simplicity and cheapness of construction of the latter commends it.

* Abstract of a paper read before the Royal Society.

The next apparatus was made according to the following instructions:

Take a wedge whose distance from the apex to the base is about 6 cm., the base of the triangular section of the wedge being about 3 cm., and the width of the wedge 6 cm. The wedge is half of antimony and half of bismuth, the division being made by the medial plane perpendicular to the three rectangular faces of the wedge cut off the apex of the wedge by a plane parallel to the base of the wedge, and exposing a surface of 1½ cm. width. This is the surface which receives the radiations, and it is lamp-blacked. A hole about 1 cm. diameter is now drilled (or it is better to file it out before the two metals are soldered together) through the two sides of the wedge, so as to leave only a thin wall along the junction of the metals at the surface which receives the radiations. A Thomson cell with suspended mirror and magnet is inserted in this hole, and the instrument is complete, and ready to be placed inside the brass box with cone already described.

The resistance of this cell is very low, and its sensitiveness thereby increased. Moreover, this type has a great advantage in the fact that the mass of metal acts as a damper upon the vibrations of the magnet, and so we have a dead-beat instrument.

The diameter of the cone to receive radiations at its mouth was 5 cm. A candle at a distance of 30 cm. from the mouth of the cone gave a deflection of 52 divisions, a reading being easily made correct to one division. A duplex lamp burning paraffine oil at a distance of 1½ meters gave a deflection of 60 divisions.

The author takes this opportunity to describe a method of carrying the delicate Thomson cells without danger of breaking the silk fibre suspension. The cell consists externally of a brass tube. A horse-shoe magnet is obtained with the distance between its legs small compared with the diameter of the above-mentioned tube. The tube is so placed as to rest on the inner edges of the legs of the magnet, with the mirror over the poles of the magnet, the mirror magnets having their poles over poles of opposite name of the horse-shoe magnet, and with the silk fibre next to the magnet. The mutual magnetic attraction takes the tension off the silk fibre and holds the mirror fixed in position, and the fibre cannot be broken by a blow given to the apparatus.

## Continuing the Pan-Electric Investigation.

The investigation of Mr. Van Benthuysen was continued before the investigating committee on April 15.

Mr. Ranney turned his attention to the withdrawal of Van Benthuysen's application, and the witness said the object of his visit to the Attorney-General was simply for the purpose of asking him to act upon the recommendation of some district attorney that suit be brought without referring it to the Interior Department. Mr. Van Benthuysen had made the request, but the Attorney-General had refused to have anything to do with it. Witness denied that anybody uttered "Pan-Electric" to the Attorney-General on the occasion of that visit. Witness had often expressed wonder at the very positive mistake made by Mr. Garland when he stated in his letter that he had been approached by somebody connected with the Pan-Electric. Nobody connected with the Pan-Electric, except Mr. Young, had accompanied him (witness) to the Department of Justice, and not a word had been said about the Pan-Electric.

Ex-Representative William E. Robinson, of New York, took the stand and read a statement in answer to that part of Dr. Rogers' testimony referring to his acceptance of stock. The statement was to the effect that Rogers had handed him some poetry on Ireland, with the remark that the accompanying papers were only fit for the waste basket, and what became of the papers he did not know. He (Mr. Robinson) had never received any stock while a member of Congress. He had introduced a resolution looking to the appointment of young Rogers as House Electrician, principally upon the recommendation of Professor Henry. Perhaps Dr. Rogers had handed him the resolution, but his memory was not strong on that point.

Attorney-General Garland was on the witness stand, on the 19th inst., for nearly four hours. He showed signs of physical weakness when he came into the room, resulting from his late sickness. He was very direct in all of his answers and gave the impression of complete frankness and truth. There has been no witness before the committee more master of himself and treated with greater courtesy. Mr. Garland contended that the Rogerses did not give him the stock. He said he acquired it by purchase. The purchase price, according to the Attorney-General, was the assessment which he had agreed to pay. The patents had no market value, although he regarded them as having great intrinsic and future merit. In describing the interview between Van Benthuysen and himself at the Department of Justice, he used the expression, "He became quite ashy," to indicate his becoming angry. He brought out the interesting fact that he was invited to go into this enterprise by Mr. Atkins in February, 1883. Mr. Atkins was then a member of Congress. Mr. Atkins has made very much of the newspapers charging that he went into this enterprise when he was a member of Congress. Mr. Garland's testimony upon that point is conclusive,

even if Senator Harris's letter to Rogers in the same month was not in existence. He thought that applications for setting aside patents should be first referred to the Interior Department. The records of two such cases referred to by him were put in evidence. The Attorney-General's conservatism on this point, his complete and thorough familiarity with all precedents, and his knowledge of principles involved in recent telephone litigation, was in marked contrast with the good-natured ignorance of his Solicitor-General, who had ordered such a suit inside of twenty-four hours' notice without consulting a single precedent.

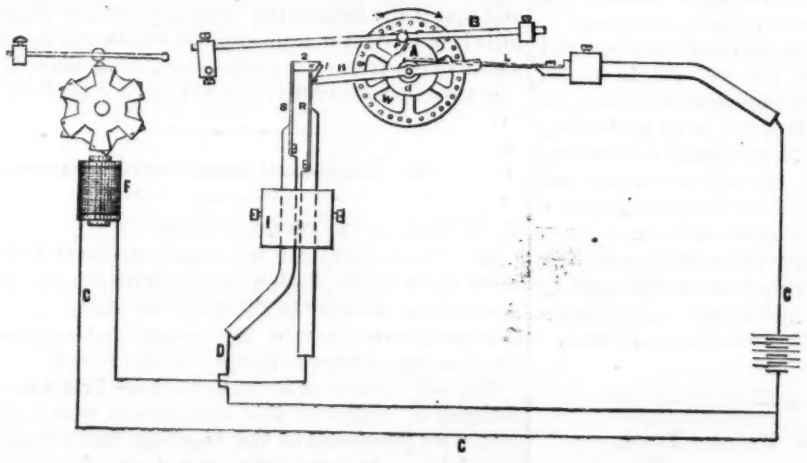
Mr. Garland clearly showed, as far as his positive assertion could go, that he had no connection with the government suit. He would not have brought it under any circumstances. He said, toward the close of his testimony on the 19th, that he still held his stock and had not change his relations to the company.

## Contact-Maker for Electric Clocks.

The obstacles that make the transmission of the electrical energy to secondary electric dials difficult and uncertain are mainly the effect of the spark resulting from the induced current at the contact terminals of the contact-maker, and the mode of operating the contact-maker by the main clock, without overtaxing its delicate mechanism with more power than is necessary for executing its ordinary functions.

In order to obviate this difficulty, Mr. Louis H. Spellier, of Philadelphia, has devised a modification of his electric clock (described in THE ELECTRICAL WORLD of Feb. 7, 1885).

Referring to the figure, *E* is the electro-magnet of an electric clock; *H* is a metallic arm designed to produce the closings and breakings of the current. One of the poles of the battery is connected by the wire *C* with the spring *L*, which rubs constantly upon the metallic disc *d*. The latter is fastened on the shaft of the escapement wheel *W*. The other pole of the battery comes from the electro-magnet *E*, and is connected with a second spring *R*, the projection *i*, of which comes in contact with a metallic pin at the terminal of the arm *H*. When this contact is made, the current is closed, and *E* can attract its armature. What is now necessary is to avoid the spark produced by the extra current, as soon as the contact between the pin and *R* is broken, since it will occasion a defective contact of the current-breaker. For this purpose, another spring *S*, the terminal of which is also provided with an inclined projection 2, is placed a little above *R*, and is connected by the wire *D* with the returning conductor. Both springs *R* and *S* are insulated from each other, and the clock movement by its bearing *I*.




CONTACT MAKER FOR ELECTRIC CLOCKS.

After the pin has been in contact for a short time with the projection of the spring *R* only, it comes in contact with the projection of the spring *S* also. At this moment, the current passes through the short circuit *S D*. Since both springs are now for a moment in contact with the pin of the arm *H*, the extra current excited in the electro-magnet at the instant the short circuit is made by *S D*, takes its way through *C, D, S, R, E*.

Heretofore, the escapement wheel of a clock, when used for the making and breaking of an electric circuit, to actuate secondary electric clocks, did not exercise any more power at the moment the making and breaking of the circuit occurred than it did while serving its real purpose, namely, to give to the oscillating pendulum of the clock the impulses needed for the continuation of its movements. The power necessary for this purpose is very slight, and not energetic enough to make a reliable contact for the passage of the electric current. But since such a contact must be a firm one to make it secure, a frequent failure of forming a complete electric circuit may be a not uncommon occurrence. That this is a circumstance which will greatly interfere with the reliability of secondary electric clocks needs no further demonstration. Several means have been devised to overcome this, but they involve complication and liability to disarrangement. In order to obtain a firm contact, Mr. Spellier has invented a mechanism by which the escapement wheel, during the time the electric contact is made, receives an additional amount of power for the operation of the contact-maker.

Its action will be readily understood.

The escapement wheel *W* moves in the direction of the arrow. Besides the contact arm *H* its shaft carries, also rigidly fastened to it, the cam *A*. The pin of the arm *H* is now in contact with the projection of the spring *S*, for the purpose of completing the electric circuit. At this time an increase of the power exercised by the escapement wheel is needed, to overcome the obstruction offered by the tension of the contact springs. To arrive at this result is the purpose of the cam *A*, and the weighted lever *B*, which is pressing against the curve of the cam by a little roller *r*. It will be observed, that just now the roller of the lever presses against the incline *i* of the cam. Thereby it imparts additional power to the shaft of the escapement wheel by its pressure, and assists to overcome the obstruction offered by the contact springs. The moment the contact pin has passed the projections of both contact springs, the roller *r* of the weighted lever reaches the lower part of the cam. It is gradually raised again as the escapement wheel revolves, and will repeat the same operation at the next contact between the pin of the contact arm and the projections of the springs. It is hardly necessary to mention, that the whole mode of operation is but a gradual storing up of a portion of the power expended by the escapement wheel during the course of its revolution, which is returned to the same at the proper moment for the purpose demonstrated.

FIG. 1.—ELECTRICAL STATION INDICATOR.

It is obvious that the relative conditions between the weight of the lever *L* and the tension of the contact springs can be easily so adjusted that when the shaft of the escapement wheel is impelled with increased force this increase is exactly absorbed by the tension of the contact springs, leaving for the functions of the escapement wheel only so much force as properly belongs to it.

All regulators that were provided with this contact-maker needed but a slight additional weight (in some instances even this was not needed). In no case were the time-keeping qualities affected to any perceptible degree.

The particulars above given are derived from a recent article by Mr. Spellier in the *Journal of the Franklin Institute*, explaining the system.

## A Novel Railway Station Indicator.

Electricity, which has long governed the movements of railway trains, is now being rapidly applied as a means of communication between the cars and those in charge of the train. In addition thereto, again, it has been called to the aid of the traveler to indicate to him the various stations at which the train stops. Strangers on railway trains, especially those which make frequent stops, are unprepared to hear the Volapük shouts of the conductor or trainmen when a station is announced, and rarely understand the names even when attentive.

In order to relieve the passenger of all anxiety, and lessen the strain on the conductor's throat, a novel station indicator has been introduced on several railroads, so that each passenger can at all times inform himself as to the next stop.

Our illustrations, Figs. 1 and 2, represent respectively a perspective and interior view of the indicators, two of which are placed in each car, one in front and the other in the rear. As will be seen, the indicator proper, bearing the names of the stations along the route, is actuated by a mechanical motor, controlled by an electro-magnet, in such a manner that it moves one entire space to display a new station sign, at each complete backward and forward movement of the armature of the magnet. Hence it makes no difference whether the circuit be normally closed or open. The indicating device proper consists of a cylindrical drum bearing upon its surface the names of the different stations along a railway. The signs are made detachable so as to be readily replaced by others, as when the route of a car is changed, and the shaft of the cylindrical drum is also made detachable, so that, if desired, the entire drum may be removed, or replaced by another. The motor is actuated by a spring, which is wound by a backward movement of the drum, which can be turned back any desired number of steps to bring it to the starting point, or to enable one drum to be put in unison with the others.

A switch is provided by which the controlling magnet may be removed from the circuit, so that the apparatus at the rear of each car may be cut out, thus removing all unnecessary resistance from the circuit.

A device is also provided for continuing the circuit from one car to another, connecting each wire of the metallic circuit from one car to the next, and at the last car connecting the terminals of the wires together, to complete the circuit. Each car being provided with this apparatus, every instrument throughout the entire train may be operated simultaneously by means of a press knob located either in the baggage car or locomotive.

In addition to the visual sign giving the name of the station the indicator is provided with a gong which sounds at each change, so that the passenger's attention cannot fail to be attracted.

This apparatus, which is made by Messrs. J. H. Bickford & Co., of Salem, Mass., as stated, is already in operation on several Eastern roads, and gives satisfaction not only to the passengers but to the train-men as well, who are relieved from the answering of innumerable questions.

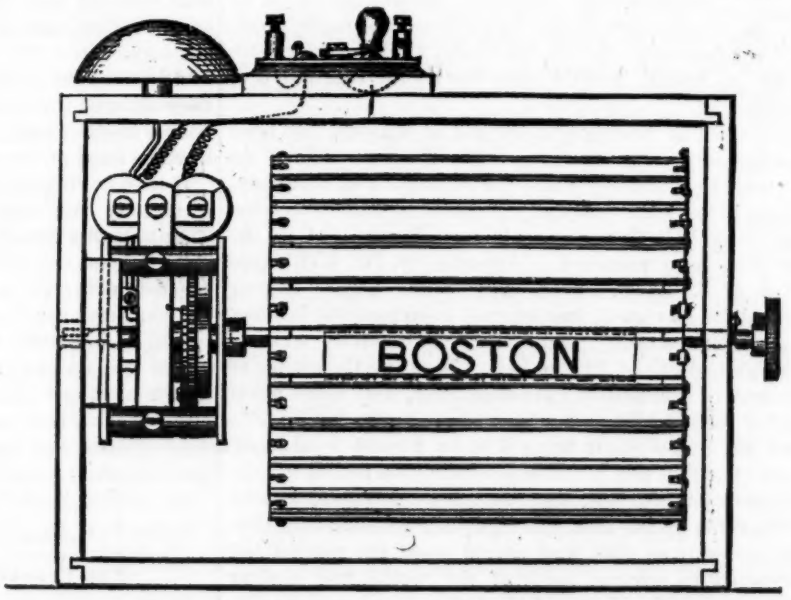



FIG. 2.—ELECTRICAL STATION INDICATOR.

## An Anti-Induction Telephone Cable.

As long as the single wire without metallic return is employed on our telephone circuits, provision will have to be made for counteracting the effects of induction; and this becomes all the more necessary in such cases where telephone wires are brought into close proximity, as they are in cables. Among the anti-induction cables recently introduced is that of the Eastern Electric Cable Company, of Boston, Mass., which possesses a number of interesting features. While serving primarily as an anti-induction cable, it is designed in such a manner as to secure great strength and high insulating qualities. The central core of the cable consists of a No. 11 galvanized iron wire, which gives the requisite strength to enable long spans to be made; in addition, this wire is grounded, and thus serves to counteract induction. Ten separately insulated conductors are laid around the iron wire in a long spiral, which keeps them in position and avoids "kinks."

Around the conductors tin-foil is wound in a spiral. It is grounded together with the iron core, and for the same purpose of counteracting induction. All this is covered with a layer of a chemically prepared insulation from $\frac{1}{4}$ to $\frac{1}{2}$ inch thick, according to the size of the cable. This insulation is also waterproof, and remains flexible in extremely cold weather, while at the same time it is said to remain

unaffected by heat. The outer covering of the cable is a braiding of hard-finished thread, which effectually protects the insulation.

The cable is claimed to test very high for insulation, and its anti-induction qualities have also been the subject of successful tests.

### The Nipher Affidavit and the New Orleans Telephone Suit.

*To the Editor of The Electrical World:*

SIR: In the case at New Orleans, the American Bell Telephone Company is seeking to enjoin the National Improved Telephone Company, one of the petitioners for the government suit.

It is stated that Mr. Van Benthuysen, president of the National Improved Telephone Company, offered to the court the entire record of the testimony before Secretary Lamar, and that the court allowed him to reopen the whole discussion at whatever length he chose, producing any evidence in his possession. The Bell lawyers waived all objections to this proceeding.

When, however, the printed record of the evidence presented to Secretary Lamar was examined, it was found "that several pages had been taken out of the book, and replaced by other printed pages, exactly similar in appearance, but containing entirely different matter. The trick was so artfully done that it might have escaped observation, but it did not. The matter which they thus attempted to suppress was an affidavit of Prof. Nipher, who, as a witness for the petitioners in Washington, testified that since the affidavit made by Adams, who was the author of the Pan-Electric book which contained the defense of that case, * * * he and Adams had tried the Bell telephone, Fig. 7 of his patent, and found that it was a practical operative telephone."

In place of the suppressed affidavit, Mr. Van Benthuysen produced two or three other affidavits, averring that the said instrument could not be made to talk, and produced instruments made in accordance with Fig. 7 of said patent which the witnesses swore could not be made to talk. In open court Mr. Van Benthuysen and his associates challenged the Bell lawyers to produce instruments made in accordance with the specifications of said patent which could be made to talk. As a result the Bell lawyers telegraphed to Boston for a pair, which were produced and talked with, and they then put the finishing touches upon Mr. Van Benthuysen by operating the pair produced by him. It is also stated that the defendants made no attempt to operate the Reis instruments. In connection with this bit of history, a little prior history of the case is of interest.

After the Pan Telephone Company of Missouri had been organized, and was ready to begin the operation of an exchange, the company wrote the National Pan Company, to learn if the latter was fully prepared to make a defense against the Bell Company. It turned out that no defense had been prepared. Accordingly, Dr. Wellington Adams, of St. Louis, a gentleman in the highest degree qualified for this work, was selected to prepare the defense. He saw that the main ground for a valid defense was the prior publications of Philip Reis. Ignoring the claims of the scores of "inventors" yet appearing, who were never heard of before 1876, but who now claim to have anticipated Mr. Bell without being able to furnish legal proof, he saw that Reis had put himself clearly on record in contemporary publications, and that his telephone, known and operated by the most distinguished scientists of Germany as early as 1862 and placed upon the market and distributed to various parts of the world, was a clear anticipation of the claims of Mr. Bell.

Moreover, there is not, so far as can yet be found, a single scientific man in any country, who has any reputation to lose, who will assert that the Reis telephones differ in principle from the modern microphone or "transmitter."

Dr. Adams also saw it in evidence in the testimony of many electrical experts, that Bell's instrument, Fig. 7, of the patent of 1876 was not operative, and could not be made to transmit speech. He had a pair of instruments constructed in strict accordance with Bell's specifications, and he also failed to make them operate. Accordingly he so stated in his summary of the case—a printed volume of about 400 pages. Being anxious to arrive at the real truth, he stipulated that he should be allowed to repeat his experiments with the aid of some person whom he might select, and the writer was selected by him for that service. We accordingly transmitted speech with all forms of telephones described by Reis, and lastly we succeeded in operating as a telephone the apparatus shown in Fig. 7 of Bell's patent of 1876.

In his affidavit made for use in the hearing before Secretary Lamar, the writer concurred in all the statements of Dr. Adams, as published in his book, excepting the one wherein he declared that the Bell instrument, Fig. 7, was inoperative, and here the facts above given were recited. In presenting this affidavit, Dr. Adams informed the attorneys of the Pan Telephone Company, that he desired to make a supplemental affidavit, correcting his prior evidence, but the attorneys, for some unknown reason, have dispensed with the further services of Dr. Adams.

After the hearing before Secretary Lamar, Mr. Van Benthuysen wrote me, saying that the portion of my testimony which declared that Bell's instrument was operative had caused the petitioners a great deal of trouble, and that other experts could not operate it. He complained that the Bell lawyers were depending upon me to prove that the instrument was operative. He wished to know if I had not in some way changed the instrument, and if so he desired me to make a supplemental affidavit specifying those changes.

My reply, written Jan. 2, 1886 (dated 1885 by mistake), contained these words: "I do not understand how this can cause you trouble. I should think it would increase the weight of our testimony. It does not affect the claims of Reis to the invention of the telephone. Our work would establish Bell's 5th claim, if the art had not been fully invented before 1876. * * * * The only fighting ground you have is the work of Philip Reis, and in my opinion you have a case that is absolutely overwhelming, your danger is in being outgeneraled by the sharp lawyers on the other side."

He, however, replied in the same strain, and I then wrote him Jan. 7: "You will make a *mistake*, if in your suit you do not admit that Bell's Fig. 7, of 1876, can be made to operate. * * * * *The Bell people will operate it in court, and will beat all your experts.*"

If now we are to believe that Mr. Van Benthuysen and his associates were making an honest fight against Bell, what are we to think of lawyers who will try to unfairly suppress testimony which had previously given them trouble with the Bell lawyers? Were they silly enough to suppose that such a shallow trick would remain undiscovered by men of such distinguished ability as those representing the Bell interests?

If we are to believe that the case in question was not given away to the Bell Company, how shall we explain the conduct of Mr Van Benthuysen in taking a position in harmony with the negative testimony of men who could not operate the Bell instrument, disregarding the warnings of those who swear that they have made it work, whose credibility Mr. Van Benthuysen was supposed to rely upon for his case, and whose testimony formed the chief ground-work of his defense? How shall we explain the fact that during the trial they did not provide themselves with competent expert aid? How shall we explain the fact that they did not operate the Reis telephones? Why did they allow the Bell lawyers to overwhelm them with a multitude of petty details; to lead them off into false issues like the Meucci and Drawbaugh claims, and frauds in the Patent Office, and against the earnest and repeated warnings of those whose labors had enabled them to get their case into court? Why have they allowed the clear and indubitable claims of Reis to be lost to sight amid the ridiculous claims of others, who have no legal proofs or competent evidence to produce?

It is to be feared that the great national telephone suit is already virtually settled. It will all end in smoke. Thanks to the ignorance or knavery of those defending the New Orleans suit, the claims of Bell will in all probability be sustained. To be sure, the New Orleans decision has not yet been rendered, but there is every indication that it will be in favor of Bell. What will then be the standing of the case instituted by the government when it comes up for hearing? Will it not then be urged that at New Orleans the whole matter was reopened and brought up on its merits, and that everything to be said upon the subject was there passed upon? FRANCIS E. NIPHER.

ST. LOUIS, April 10.

### The Franklin Institute Dynamo Tests.

*To the Editor of The Electrical World:*

SIR: We crave permission to again occupy a small portion of your space in which to make a reply to the letter of Mr. G. B. Prescott, Jr., published in your issue of March 20. It is possible that some of your readers have not quite grasped the point at issue between Mr. Prescott and ourselves, and this now becomes slightly more involved since that gentleman chooses to shift the ground he occupied when first calling us to task. He primarily taxed us with using *very crude apparatus*; to this charge we not unnaturally demurred in our communication to you. He now changes his tactics, thus again verifying our former statement that he is forgetful of prior utterances. To quote from his letter to which we have above referred: "The substance of their complaint is simply to the effect that I have taxed them with having used *cruder instruments in their experiments than were employed by the Franklin Institute Committee*," etc.

It is probably within the remembrance of your readers that the only example given by your correspondent of our very crude apparatus was a voltmeter of the Ayrton and Perry type. Now, we do not claim, nor have we claimed previously, that this instrument ranks with a Helmholtz reflecting galvanometer "sensitive to a practical limit" (whatever this latter expression may mean), neither would we assert that a Snider rifle is not a more crude weapon of warfare than a Martini-Henry, but we do say that as accurate shooting may be, and has been, obtained with the one as with the other.

The simple fact remains, that Mr. Prescott persistently ignores our reiterated proofs that the instrument was perfectly reliable. With resistances correctly measured by an accurately adjusted Wheatstone bridge, with the current indicated on a Siemens electro-dynamometer—which Mr. Preece, in his last lecture before the Society of Arts, says still remains master of the field—and with the calculated results from these measurements in accord with the indications of the voltmeter, what else can be required?

Further into the personal matters, to which Mr. Prescott again refers, we decline to go. Those of your readers who have followed this controversy can decide between us, and by their judgment we are content to abide.

H. ALABASTER, GATEHOUSE & CO.

LONDON, April 8, 1886.

### Some Light on the Franklin Institute Friction Measurements.

*To the Editor of The Electrical World:*

SIR: There appeared in your columns lately some interesting letters from Messrs. Heinrichs, Marks and Prescott in regard to the accuracy of the tests made by the Franklin Institute Committee on the Edison and Weston dynamo machines. Mr. Heinrichs challenged the results and undertook to prove that the friction as measured by the committee was entirely too low.

I have had occasion during the past week to make friction measurements on one of the machines tested by the committee with a dynamometer entirely different in construction from that used by them, so that my results may be of some interest. The machine in question is the Weston 6 W I, and the dynamometer is of the cradle or Brackett form. The dynamometer is an exceptionally fine one, and is provided with all the appliances necessary for accurately centring the machine, so that any error due to its centring can be of little moment. As the friction measurements were merely incidental to the work on which I was engaged, I took no pains to bring the friction down; but on the contrary, I set the tension on the driving belt greater than that necessary to drive the machine with full load, and the measurements therefore represent the maximum friction under normal conditions. The results are as follows:

| Speed. | Friction in h. p. |
|---|---|
| 1271 | .23, brushes off. |
| 1269 | .29 " on. |

The speed, it will be seen, is higher than that at Philadelphia, which, of course, makes the friction higher also. Tests made from time to time on other armatures confirm these results, being in fact generally more favorable. I have invariably found with armatures of the size of the Weston 6 W I, that when the journal friction rises to even .33 H. P. the boxes become decidedly warm. I think, therefore, that Mr. Heinrichs' position is untenable, and that if the substantial accuracy of the Philadelphia tests is to be denied, it must be on some other grounds than errors in the friction measurements. JOHN F. KELLY.

WESTON LABORATORY, Newark, N. J., April 17, 1886.

### The Hanging of Lamps Across Streets.

*To the Editor of The Electrical World:*

SIR: I have just had my attention called to the statement made by Mr. Ridlon, at the National Electric Light Association meeting in February, in which he refers to this company as having had trouble and accidents from the hanging of electric lamps over the streets.

The only trouble or accident we have ever had from the hanging of lamps in this manner was with a mast arm, which we purchased of the Star Iron Tower Company, of Fort Wayne, Indiana. We erected one of them according to their written directions, and had used it but a few days when it broke down; but as the accident occurred in the day-time it did no more damage than to render the arm useless, and to break the lamp. It did not interfere with our circuit in the least.

In justice to the Star Iron Tower Company we would say, that we think the breaking of the arm was owing to poor material used in its construction, it not being sufficiently heavy to sustain the weight put upon it. They took back the arm, and would have furnished us a heavier one to replace it, but our company did not feel confidence enough in that mode of hanging the lamps to try it again. This led us to adopt one of the methods which we now use, namely, that of running the hood on pulleys on two wires or iron rods strung from the top of the poles from opposite corners of the streets, and suspending the lamp from the hood. We have two of these in use now, and have had for a year or more, and have had no trouble with them. We can easily trim the lamps by pulling them in from the middle of the street to the pole, and then running them out again without interfering with our circuit. The city authorities liked this method so well that they ordered us to suspend more lights over the streets, but as these iron rods or wires sag in the middle, and we had to guy the poles, we got up the fixture we now use, a kind of tramway made of light angle iron, the hood running in between the two sections on rollers, which can easily be pulled in and out, and it does not sag in the middle or pull the poles together. We have had no trouble with this, having had some in use over a year. The only objection we have to them is the cost, but we consider them the safest fixture that we have

thus far seen. We do not have to guy the poles, as the tramway does not pull them together, but simply rests on the top or arm of the poles, and does not sag in the middle as the wires do.

H. H. FAIRBANKS,
Treasurer Worcester Electric Light Co.

WORCESTER, Mass., April 12, 1886.

### Battery and Line.

*To the Editor of The Electrical World:*

SIR: On page 31 of Maver & Davis' book on "The Quadruplex" the statement is made: "When a positive pole of a battery is placed to a line wire, the current is supposed to flow out on the line; when a negative pole of a battery is to the line, the current is supposed to flow in from the line."

On page 7 of Kempe's "Hand Book on Electrical Testing" this statement is made: "It is usual to have the positive pole of the battery to earth so that a negative current flows out to the line," etc., etc.

There appears to be a sort of a contradiction. Is it in their statements or is it in my understanding? C. W. P.

NORTH ADAMS, Mass.

ANSWER.—Maver and Davis are correct. Kempe's expression is somewhat loose.—EDS. E. W.

### The Best Kind of Lightning Rod.

*To the Editor of The Electrical World:*

SIR: Will you please tell me, through your columns, what is the best kind and shape of lightning rods and tips for a dwelling-house? My house is built where the bedrock is not over 8 feet below the surface, and a sink-hole that is being dug, 15 feet from the house, has gone down 20 feet through this rock. Under these conditions, what would be the best way to fix the bottom of the rod?

SOUTH BETHLEHEM, Pa. J. E. T.

ANSWER.—According to the latest researches of Professor Hughes, the best form of lightning conductor is a flat ribbon of copper, or *stranded* iron wire. Spang's "Protection against Lightning" will give a number of useful hints as to the erection.—EDS. E. W.

### Volts and Amperes.

*To the Editor of The Electrical World:*

DEAR SIR: Would you be kind enough to answer the following for a young man desirous of becoming an electrician. I learn from books that one horse-power wholly utilized, theoretically would produce 746 volt-ampères, (or E. M. F. 746, in a resistance of 746 ohms) the result being *one* ampère; or with an E. M. F. of 27.3 volts through one ohm would produce 27.3 ampères. Now in the first case I would like to know, why not with an E. M. F. of 746 volts in a resistance of say *only* 1 *ohm*, there may be 746 ampères produced or equal to 556,516 volt-ampères instead of 746 volt-ampères, only. J. C. MCCLAIN.

NEW YORK CITY.

ANSWER.—Your assumption that an E. M. F. of 746 volts at the terminals of a resistance of 1 ohm gives 746 ampères and hence 556,516 volt-ampères is perfectly correct.—EDS. E. W.

### Sizes of Wire for Lighting.

*To the Editor of The Electrical World:*

SIR: I am desirous of learning the standard rules for figuring size of copper circuits for incandescent lighting. Have you ever published the formulæ, or can you furnish me with it? J. T. D.

LAFAYETTE, IND.

ANSWER.—Munro and Jamieson's "Electrical Pocket-book," obtainable from this office, contains many useful hints and tables as to wiring.—EDS. E. W.

### Dynamo Patents and Pronunciations.

*To the Editor of The Electrical World:*

SIR: (1) Can "compound" dynamos be manufactured by any one in this country, or are they controlled by patents? (2) What is the *correct* pronunciation of *dynamo?* E. MCL.

GREENCASTLE, Ind.

ANSWER.—(1) Mr. Ch. F. Brush owns a United States patent, which covers the compound winding of dynamos. (2) At the last meeting of the Electric Light Association it was voted to adopt the pronunciation which laid the accent on the first syllable, the *y* being given the long sound of *i*.—EDS. E. W.

### The Efficiency of Electric Motors.

*To the Editor of The Electrical World:*

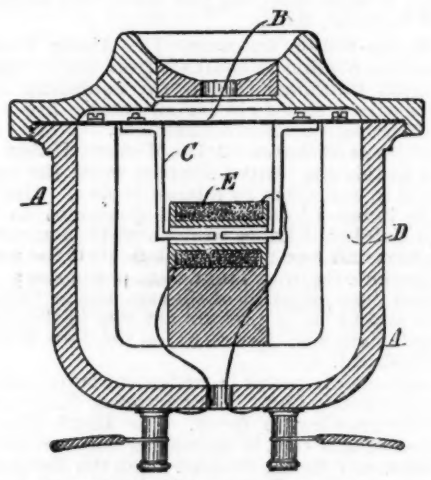
SIR: Referring to your comment on my letter under the above heading, on page 166, that "the dynamic inductive energy of a current varies as the square of its intensity," I would admit that that is quite true with a series motor, in which the same current both energizes the field magnets, and then flows through the armature to be acted upon by induction from the magnets. But in this case the magnetic field *remained constant* while the current increased in the armature. Consequently, the motor could not have been series-connected, and there would be no such double or cumulative action of the current. It would therefore seem that the work done by the motor should have increased approximately as the current.

Mr. Mordey has since stated, however, that there was an unascertained loss in transmission (in the dynamometer), and that it was *not* included in the horse-power measurements given in the tables, and should be added to them. This is to be regretted, even if the readings given were in the main or relatively correct, as, not knowing either the value of $E$ or the work really done by the motor with the different currents, it is now evidently impossible for us to calculate with accuracy either its electrical or mechanical efficiency. F.

NEW YORK CITY.

### Professor Thompson's Magneto Telephone.

In our issue of April 10 we described the latest form of Prof. Silvanus P. Thompson's valve telephone transmitter, which operates without the employment of carbon contacts, and which was designed to overcome the use of these and of a diaphragm. Recently there has been patented by the same inventor an interesting modification of the telephone receiver, which we illustrate in the accompanying engraving. The object for which it is constructed is to dispense with the mechanical or magnetic strain put upon the central portion of the telephone diaphragm. This is accomplished by causing the variations of the current to act upon movable pieces, forming part of a circuit independently magnetized and attached to a spring or other stiff body of non-magnetic material. As will be seen, the spring $B$, which may be of mica, ebonite, wood or brass, has the pieces $C$ attached to its outer edges. These pieces form part of a magnetic circuit by reason of their being in proximity to a magnetized bar $D$, and move independently of the main body of the magnet. The ends of the pieces $C$ constitute the cores of the coil $E$; the terminals of




THOMPSON'S MAGNETO TELEPHONE.

each are connected to the external circuit. When an instrument so constructed is used as a receiver, the currents in the coil cause the movable pieces of the magnetic circuit to act upon the opposite outward parts of the elastic, stiff body to which they are attached, so that the central portion is vibrated accordingly.

### On the Running Down of Batteries as Influenced by Their Performance of Mechanical Work.*

BY DR. OLIVER LODGE.

Although there is nothing but what is perfectly well known in the relation between the running down of a battery and the amount of external work it is doing, yet, inasmuch as batteries are not unlikely to be more and more generally used as sources of mechanical power, it may be worth while to answer the question of the Cromer "Student" in your issue of 22 January somewhat fully.

The correspondent describes an interesting model of an electric hammer driven by a battery, which does about 150 foot-pounds of work per minute, or has about the two-hundredth of a horse-power; and he then proceeds to say that whereas the books tell him that his battery should run down faster when the hammer is stationary than when it is at work, he finds no such result; and he implies, or at least it is not unnatural for him to think, that he would have expected the battery to run down faster while doing mechanical work than while not.

Now the first thing to thoroughly grasp is that the consumption of material in a battery is simply porportional to the strength of current flowing through it, provided, of course, all local action is avoided. It depends on the quantity of electricity transmitted and on nothing else. The amount of zinc dissolved in every cell of a series battery per ampère hour is accurately known and is 1.21 grammes.

Hence any cause which increases the strength of current hastens the running down of the battery, and any cause which opposes the current retards the consumption of material. Now the performance of mechanical work of whatever sort, by a current, necessarily sets up an opposition E. M. F. and weakens the current, as may be proved, and was proved by Helmholtz in 1847, as follows:

Let $E$ be the electromotive force of a battery, supposed constant, and let $C$ be the current flowing round a circuit of total resistance $R$, resistance also being supposed constant. Then, by definition of E. M. F., the "horse-power," or work done per minute by the current, is $E\,C$.

As the current flows round the circuit heat is generated, and this heat was found by Joule experimentally to equal $R\,C^2$ per unit of time.

Now if we first suppose that there is no working machine in the circuit—*i. e.*, no machine actually at work—stationary machines there may be as much as one pleases, and they may be holding up weights; but they must not be moving either in the way of raising or lowering them, neither must there be any chemical decomposition going on, or any form of activity other than that already considered in the battery; I say, given all these conditions, it follows, by the conservation of energy or the first law of thermo-dynamics that

$$E\,C = R\,C^2, \qquad (1)$$

an equation which asserts, when we compare it with the Ohm's law definition of $R$ $\left(R = \frac{\text{E. M. F.}}{\text{current}}\right)$, that throughout the circuit, under the supposed circumstances, there is no E. M. F., but $E$.

But now make another supposition: Suppose a working machine, or a decomposition cell, or some other form of activity, introduced into the circuit, whereby the current shall be made to do work—raising weights, for instance, or turning machinery—and let the horse-power of this machine be called $P$. Then no longer can we equate the power of the battery with the heat produced; we are compelled to take into account every form of energy which is being developed, mechanical or chemical as well as thermal, and so our equation becomes—

$$E\,C = R\,C^2 + P \qquad (2)$$

And if again we compare *this* with the Ohm's law definition of $R$ $\left(R = \frac{\text{E. M. F.}}{C}\right)$ we find that $E$ is no longer the sole or effective E. M. F. in the circuit, but that the total E. M. F. is $E - \frac{P}{C}$; that is, there is an opposition E. M. F., of strength $\frac{C}{P}$, and it is natural to consider this opposition E. M. F. as set up in and by the moving machine; or in and by the decomposition cell, if such it be that has been included in the circuit, in which latter case the opposition E. M. F. is known as polarization. And be it noted that it matters not whether decomposition goes on in a special cell or in one of the battery cells—*wherever* it goes on it subtracts its full quota of E. M. F. from the current, and is equally well called polarization.

It is plain, then, that, since by an active machine the total E. M. F. of the circuit is diminished while its resistance remains unaltered, it follows that the current must be weakened. And inasmuch as the wear of the battery depends simply on the current, the wear of the battery is likewise reduced by the activity of the machine.

It is easy enough to write down an expression for the strength of the current in terms of the power which the machine is exerting, *i. e.*, the work it is doing per second, by simply solving equation (2); and it is

$$C = \frac{E}{2R}\left\{1 + \sqrt{\left(1 - \frac{4RP}{E^2}\right)}\right\}$$

which shows that the greatest possible mechanical power obtainable by perfect appliances from the given circuit is $\frac{E^2}{4R}$; and that when this is obtained an equal amount is expended in generating waste heat. Moreover, it shows that the consumption of material in the battery under these circumstances is exactly half what it is when the machine is held stationary and not allowed to work, and that no slower battery wear than this half-rate is possible, so long as the machine is really worked by the battery and is not driven by some outside power; but that any faster wear is easy, up to the maximum, when the machine is stationary, of $\frac{E}{R}$.

The maximum rate of wear is $\frac{E}{R}$, corresponding to external power 0, and internal or waste power $\frac{E^2}{R}$.

The minimum rate of wear is $\frac{E}{2R}$, corresponding to external power $\frac{E^2}{4R}$ and internal or waste power $\frac{E^2}{4R}$.

But if the mechanical power obtained be small and insignificant compared with that put forth by the battery, as is always the case with small size models which can never be efficient and economical motors, then the rate of wear is so nearly equal to its maximum value $\frac{E}{R}$ as to be indistinguishable from it except by careful measurements.

Just one point before closing. No more work is called for from the battery, whether a solenoid be sustaining a weight or keeping a piece of iron magnetized, or whether it is doing no such thing. Under all stationary circumstances the whole of the energy is frittered away as heat in the coil; the mere holding up of the weight or keeping a magnet excited involves no direct expenditure of energy.

* *The Engineer.*

For a weight may be supported by a pillar, or a magnet may be struck into permanence by hardening it and fixing its molecules.

But a weight may also be supported by a man, or by a jet of water, and a magnet may be maintained by a constant current flowing round it. Is there no expenditure of energy here? Do not the things get tired?

Yes, in truth they do, and there is expenditure of energy, *but not in holding the weight or maintaining the magnet;* it is all expended in bye-issues, it all reappears as heat. If we knew no simpler plan of keeping a weight supported than by keeping a man to hold it up, like Atlas, we should have to pay him his day's wage and keep him working, wastefully generating heat; but we do know a simpler plan—we use a prop. Similarly, as we know no simpler means of maintaining a powerful magnet than by keeping a current constantly flowing round it we have to keep such a current flowing, although we feel that it is really all running to waste, and that a simple prop would be a far better plan. This, however, is the present state of our ignorance; we know no prop for magnetism of any real strength. Here is a field for discovery; the field magnets of twentieth-century dynamos will probably be permanent ones, with the initial magnetic susceptibility of the softest iron, struck into the magnetic rigidity of the hardest steel.

## NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, April 19, 1886.

After a three months' test, the directors of the Brooklyn Elevated Railroad Company have adopted the Carey system of electric time, and have made a contract with the Electric Time Company, owners of the system, to supply all their stations for a term of years. This would seem to indicate the removal of a common prejudice against the utilization of electricity for time devices, and I hope to see the system adopted by railways generally.

The Excelsior Electric Company, of 13 Dey street, New York, and 198 to 216 Willoughby street, Brooklyn, will remove its New York office to 9 Dey street, where it expects to fit up a complete incandescent electric light plant for the offices. The company is actively engaged filling some large orders, and claims to stand among the largest in output of arc light plants last year.

Mr. George H. Pride, the electrical engineer, is now giving special attention to wiring for telegraph, telephone and electric light, and the manufacture of some electrical specialties. Mr. Pride has had many years' experience as an electrical engineer, and has a large budget of interesting experiences to draw on.

The most cursory examination of THE ELECTRICAL WORLD, or particularly of the "Electric Light" notes, will show that the business of lighting is remarkably brisk. One hears of new companies, new central stations, and new isolated arc or incandescent plants in every direction. This activity has made itself felt in many collateral industries, and I was very much impressed last week with one example of its effect. I need not remind your readers that one of the principal adjuncts to a successful system of electric lighting is good belting. On looking into Charles A. Schieren & Co.'s Electric Leather Belting Works, 47 Ferry street, I was shown four enormous rolls of leather, which I was informed were belts for the Citizens' Electric Light Company, of Brooklyn, which is just completing a fine large station, corner of DeKalb avenue and Navy street. Two of the belts were 115 feet long and 36 inches wide, of double "electric" belting; one was 82 feet long; and the fourth was 73 feet, both being double also. The order includes in addition 2,000 feet of 8-inch electric belting, and the price of the whole is $4,000. As I looked at the symmetrical and highly finished belting, and remembered that Brooklyn, now one of the best lighted cities in the world, was only two years ago almost unblessed by electricity, I could not help thinking that some of our mechanical, engineering and manufacturing friends have cause for congratulation in the new and profitable field that electric lighting has opened up to them.

The Shaver telephone system goes on prospering and to prosper. The telephone is largely in demand, and I am told that some Bell managers are quite partial to it, looking on it as a useful supplementary to their exchange systems. The Shaver exchange is itself in better shape than ever, and last week I talked all around the city over lines connected up for me, as I indicated my wishes, at the offices in Greenwich street. Not only were the circuits as angular as the horse that Mark Twain could use for a hatstand, but "central" could "cut in" with the utmost ease, hear if necessary what was going on between conversing parties, and take new instructions from them. Mr. Shaver showed me a circular that is being distributed by one of his active agents among the people of a Western town of some size. It is unique in the telephone subscription line. The first year, the subscriber pays in enough for the purchase of telephones for his own use, and for line wire according to the distance, and the manager of the exchange then keeps the whole in order for a charge of about $1.50 per month. One of the Pennsylvania agents is about to put in an exchange system.

Mr. H. N. Curtis, special agent in this city for the Thomson-Houston Company, has secured lately the contract for lighting the city of Yonkers with 45 arc and 150 incandescent lights. The whole plant is to be complete this month, a 30-light dynamo being put in place first. Mr. Curtis has also taken an order to furnish a 30 arc light plant, with engine and boiler, for the Panorama Company, Fifty-seventh street and Seventh avenue.

J. S. Pratt & Co., large dealers in first-class mechanics tools, cutlery, hardware, etc., at 53 Fulton street, are now carrying a full line of Tucker & Baxter's electrical supplies.

Mr. A. T. Smith, 6 West Fourteenth street, formerly Smith, Bridge & Co., is prepared to furnish lava tips in any quantity for multiple gas lighting. Mr. Smith has been experimenting on improvements in this line of goods for many years, and after careful work has invented and patented an ingenious adjunct to the electric gas-lighter.

W. T. H.

HORNELLSVILLE, N. Y., April 17.

One of the most liberal offers ever made to supply electric lights for street purposes has been made to the Hornellsville corporation by a new local company recently formed for that purpose. The village voted an appropriation for electric lighting and a local company was promptly formed by well-known citizens, who offered to supply the village with 52 guaranteed 2,000 c. p. arc lamps, to light them every night in the year and all night for $6,000, including everything, or less than 32 cents per lamp per night. The offer will undoubtedly be accepted. It was estimated that the total illumination received by the present system of lighting was about 3,000 c. p., and that by the above offer it would get about 35 times as much. Hornellsville, therefore, expects to have the cheapest and best lights going. The village also appropriated money for a fire-alarm telegraph system, and after a very careful and thorough investigation by village officials, the well-known Gamewell fire alarm was adopted and a contract closed at once with that company. Mr. Grimwood was in town in behalf of the American Electric Manufacturing Company, of New York, whose system is to be used by the above local company, and Mr. T. Torrey was also here in behalf of the Utica Fire Alarm Telegraph Company, of Utica, N. Y., who are agents for the Gamewell Company for these parts. Considering the enterprise of the citizens it is difficult to understand why so little interest is taken in the telephone exchange established here, notwithstanding the liberal inducements of the New York and Pennsylvania Telephone and Telegraph Company, of which Mr. W. N. Estabrook, of Elmira, is General Manager, and which furnishes a very good day and night service to the subscribers. The number of subscribers has run down to almost 30. Surely this state of things should be changed in a population of 10,000 inhabitants.

T.

## NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Mass., April 19, 1886.

The Eastern Electric Cable Company, of this city, has recently supplied a large quantity of its durable and efficient electric wire to the Merchants' Electric Light and Power Company and to other electric lighting enterprises.

C. J. H. Woodbury, Esq., gave a very interesting and instructive lecture, on last Thursday evening, at the Institute of Technology, before the senior class in electricals. Subject: "Electric Lighting in Relation to Fire Risks."

Messrs. Riley & Gray, of Boston, agents for the Howard & Bullough patent electric stop motion drawing frames, report an increased demand for this novel and useful apparatus. A large order has just been filled to the Lyman Mills, at Holyoke, Mass.

The Martin-Wilson Automatic Fire Alarm Company, of this city, has obtained a contract from the owners of the Washington Building, Boston, for equipping the entire structure with a closed circuit automatic fire alarm system, having engine house connections.

Large blocks of shares of the Western Union were disposed of in this city during the past week, the sales being attributed to unloading by a large broker. The action is said to be induced by a published statement to the effect that the Knights of Labor were about to inaugurate a boycotting movement on a large scale against the company.

The Judkins Railway Train Signal Company has about completed the equipment of the cars on the "Shore Line," which is said to be a preliminary step to the placing this company's signaling apparatus on the New York & New Haven Railroad.

The high-candle-power incandescent lamps made by the Bernstein Electric Light Manufacturing Company seem to be steadily growing in favor. The Brush Electric Light Company, of this city, is increasing the number in use on its circuits, and during the past week the Merchants' Electric Light and Power Company has begun to use them, having placed a number in the "World's Museum." These lamps are run in series on arc-light circuits, and appear to be giving entire satisfaction.

A very handsome incandescent dynamo of two hundred 16 c. p. lights' capacity has just been placed in the Bay State Sugar Refinery, Boston, by the Ball Electric Light Company. It is a unipolar Ball machine, and said to be the largest Gramme incandescent dynamo ever built; and the company claim that it is self-regulating—giving from one light to the full limit of its capacity, as may be required.

Mr. H. McL. Harding, who has been manager of the Massachusetts Power Company (using Daft system), recently resigned his position to become the New England agent of the Sprague Electric Railway and Motor Company, of New York. Mr. Harding is well-known in electrical circles, and enjoys the reputation of being energetic, enterprising and thoroughly posted in the practical working of power systems. He has been identified with this line of business for a number of years. The directors of the Massachusetts Power Company gave Mr. Harding a high testimonial of their regard and appreciation by passing a vote of thanks for his successful management of the affairs of the company, and wishing him a prosperous future. Mr. Harding's retirement from the Massachusetts Power Company is greatly regretted by the directors and his old associates. The Sprague Company should be congratulated on having secured the services of one who is so well qualified to push its interests in this section.

The Hartford Hammer Company, of Hartford, manufacture a fine grade of steel hammers, specially suited for manufacturing electrical goods. This company is prepared to make any style of hammers that may be desired.

In the Snow-Alley trial at Barnstable, Mass., the arguments were concluded on last Thursday, and the case given to the jury. The following morning the jury came in and reported a disagreement, after which they were discharged.

At a special meeting of the Brockton (Mass.) Common Council held last Friday evening, the Committee on Street Lighting was authorized to contract for five years for the running and care of arc lights at an expense of $150 per light per annum.

The Schaefer Electric Light Co., of Cambridgeport, Mass., is making an installation of its system in the Continental Brewery, at Roxbury. The Armington & Sims engines will be used.

The factory and offices of the Schaefer Electric Manufacturing Co. are located on the corner of Osborne and Main streets, Cambridgeport, Mass. The company has been in existence only a few months, yet the push and go-aheadativeness of its promotors, backed by a reliable dynamo and an excellent lamp, has already brought the company prominently before the public. The company has fitted up several plants in New England, and in every case a satisfactory report has been given. The facilities for manufacturing both dynamos and lamps are such as to enable this company to fill orders promptly. The company manufactures lamps from 10 to 100 c. p. and with its system all sizes can be used, it is said, on the same circuit. The carbon differs from that used in any other incandescent lamp, it being an animal carbon (silk specially prepared) for the filament, the process having been patented by Mr. Frederick Schaefer, the electrician of the company. The fibre of this material is continuous throughout its length and uniform in its section; it is so flexible that it can be straightened out without breaking, and will stand a very high incandescence, producing an extremely white and pleasing light. The dynamo, lamp and other apparatus made by the Schaefer Company were illustrated in THE ELECTRICAL WORLD April 10th.

W. I. B.

## PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
PHILADELPHIA, April 19, 1886.

The underground question took some shape here this week, by Councils giving the contract to the Standard Underground Cable Company, of New York, for the laying of 8,000 feet of cable, and also to the Tatham Bros. for 2,000 feet. The work of laying will be begun in a few weeks and the ultimate success of the cables laid will determine what system is to be used generally here in Philadelphia.

The Rue Injector Manufacturing Company reports business as very brisk, especially in the South and West. It is highly lauded for its style of injectors, and has good reports from all goods sent out.

The Clay Telephone Company appealed this week from the judgment rendered against it here recently by the courts.

Harrison Frazee & Co. have ordered an additional number of lights from the Edison Company, of this city.

The Fidelity Trust & Safety Deposit Company have closed with the Edison Company for a plant, and are building a structure for the installation of the plant.

The S. S. White Dental Company are receiving large orders for their platinum.

The Westinghouse Electric Company has selected a site on Sansom, above Seventh, for its central lighting station, and will in a few days complete arrangements for the erection of the building.

Stephen Holbrook, the manager for the Schuyler Electric Light Company, has just returned from a trip through the State, and reports all the plants as working with the greatest satisfaction. He has just wired his office at Third and Chestnut for the use of lights from a plant which his company installed near by.

The plant recently established at Trenton by the Westinghouse company was sold by them on last Thursday to the People's Electric Light Company, of Trenton. Price not given.

It is currently stated in this city that the Brooks Underground Company is to lay 25,000 feet of cable for the Metropolitan Telephone Company, of New York City, as soon as the latter obtains a license from the Commissioners.

Carl Hering, of this city, who is well known to the readers of THE ELECTRICAL WORLD from his admirable articles on the winding of magnets, was granted a patent this week at Washington on his unipolar dynamo machine.

Among the many new electrical instruments which James W. Queen & Co. show this week are an absolute electrometer, measuring potentials of from 600 to 6,000 volts. This is the invention of Sir Wm. Thomson. Its adjustment is very fine, and the slightest deflection is shown. Many other new instruments which they have just received are fully explained in circulars which they will be pleased to forward on application.

E. F. I.

## WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, April 17, 1886.

The Van Depoele Electric Railway, in Montgomery, Ala., was started this week, and is now running regularly and successfully. It is rumored that both the north and west side street railway companies in Chicago are making investigations of the cable and other systems of propelling street cars with the idea of adopting something to take the place of horses. Why does not some enterprising company make a strong pull to get them to adopt the electric system? It would be just the thing for these companies, as the river would not be any obstacle whatever in the way of adopting the electrical system, while it forms a very formidable objection to the adoption of the cable system.

One of the most interesting conversationalists it has been my fortune to listen to for a long time is Dr. Cushman, to a history of whose claims you gave considerable space two weeks ago. The venerable doctor is really a fascinating talker, and states his case in a remarkably clear and concise manner. He is evidently firmly convinced that he was the first inventor of the telephone, and his story of his experiments and inventions as it comes from his lips is absorbingly interesting; and no less so is his narrative of his negotiations with the American Bell Company, from whom he drew a regular monthly salary under contract for three years.

The city of Indianapolis has won its fight with the Central Union Telephone Company in that it has seen to it that by no hook or crook should the company be allowed under the new law to charge anything in the way of extras above the three dollar rate. And now having come off victor, the city does not seem by a long way to be so pleased at the result as was anticipated, for to-day the city of Indianapolis is practically without telephones. In making its fight the city probably thought it was taking steps which would lead to the curbing of a powerful monopoly. Instead it finds that it has shattered and driven from its limits a legitimate business enterprise. Having won the fight, are the citizens of Indianapolis satisfied with the result? I think not. Already the business men of the city are beginning to feel the inconvenience of being without the telephone, and what are the prospects of getting telephone service from others than the Central Union Company? Very poor indeed. The Judiciary Committee of the City Council, which met a few days ago to hear propositions from the several telephone companies desirous of succeeding to the franchise withdrawn from the Central Union Company, is very much discouraged, I understand. The committee propounded to the applicants a few questions which proved very embarrassing to the latter. Some of these were: Can you guarantee that the

service will not be interfered with by injunctions in favor of the Bell Company? Is your telephone in use anywhere? Have you a complete exchange system? Have you ever been enjoined? and other questions in this strain. It is needless to say that the answers were not such as to lead the committee to think that the task before it is an easy one. However, the citizens of Indianapolis have made their own bed and should be content to lie on it.

Col. S. G. Lynch, broker, 144 Lasalle street, Chicago, furnishes the latest telephone quotations :

| | |
|---|---|
| Bell of Mo. | $147@$151 |
| Chicago | 365@ 375 |
| Central Union | 50@ 52 |
| Colorado | 19@ 21 |
| Cumberland | 70@ 75 |
| Great Southern | 25@ 30 |
| Great Southern, Scrip, 65 cents on the dollar. | |
| Iowa | 15@ 18 |
| Michigan | 65@ 67 |
| Mo. & Kan. | 52@ 54 |
| Mo. & Kan., Scrip, 53 cents on the dollar. | |
| Rocky Mountain Bell | 40@ 45 |
| United | 15@ 17 |
| Wisconsin | 108@ 110 |

W. A. K.

## THE TELEGRAPH.

**Sued for Raising Rates.**—The Mandan, Dak., *Pioneer* has sued the Western Union Telegraph Company for $5,000 damages for raising rates on news dispatches contrary to the terms of a contract made in 1884.

**Underground Schemes.**—The Long Island Underground Telegraph Company, of New York, has been organized by Mr. George B. Pennock, a well-known telegrapher, with a capital of $100,000, to do some projected underground wiring in and around Brooklyn.

**Postal Telegraph Bonds in Court.**—A suit has been begun at Barnstable, Mass., in the Superior Court by Chester Snow against John B. Alley to recover the value of 150 Postal Telegraph bonds which it is claimed were obtained by the defendant under promises which he never fulfilled. The bonds had a par value of $1,000. Col. R. G. Ingersoll is of counsel for the defense.

**The French Cable Broken.**—A dispatch received in this city on April 19 stated that the French cable broke the previous afternoon, 220 miles from Duxbury, Mass. At the executive offices, in the Western Union Building, it was stated that efforts were being made to pick up the ends, but thus far without success. The line broken is a minor one from Duxbury to St. Pierre.

**"Colossal Deviltry"** was the term used last week by Mr. Roscoe Conkling in speaking of the damage inflicted on his clients, the representatives of the Bankers & Merchants' Company, by the Western Union Company, when it seized the lines last summer. The case is still going on, the Western Union Company holding that the action in the New York Supreme Court for $2,000,000 damages cannot be properly heard until the determinatian of another suit in the United States Court as to the ownership of some of the lines concerned.

**Assessment for Subway Commission.**—The New York Senate Finance Committee has reported a bill empowering the Controller to ascertain the number of miles of wire operated by electric companies which refuse to report to the Controller for assessment for the Electric Subway Commissioners, and when companies refuse to pay assessments authorizing the Controller to direct the sheriff to levy upon and sell any of the property of the recalcitrant company. The sheriff's warrant shall be a lien upon the real estate of the company.

**Indicted for Wire-Tapping.**—In St. Louis interest centres about the grand-jury room and the courts. Martin Irons, A. C. Coughlan and George M. Jackson, three of the leading railroad strikers against whom bench warrants were issued in connection with the alleged plot to tap telegraph wires, furnished bail on the 17th inst. in the sum of $800 each. S. M. Nichols, the other party against whom a bench warrant was issued in the case, is out of the city, but, it is expected, will surrender himself and give bonds as soon as he returns. Mr. Irons says that he could easily clear himself of the charges brought against him. Messrs. Coughlan and Jackson speak in the same strain. It is thought that a conviction is not likely on the evidence obtainable.

**Messenger Boys on Strike.**—The 22 messenger boys who deliver news slips among the brokers down town for Kiernan's agency get $4 a week. William P. Sullivan, Mr. Kiernan's partner, has declined to pay any more, and when Johnny Norris would not work over hours without extra remuneration he was discharged. This was on Wednesday night last. Then the remaining 21 boys said "Johnny" must be taken back or they would strike. This Mr. Sullivan refused to do, and the boys left the office, saying : "When we come back it will be for $5 per week." District messengers have been called in, but when they appear on the street they are terrorized by the regular boys. Senator Kiernan is inclined to pay the $5, but Mr. Sullivan has not at the time of writing taken them back.

## THE TELEPHONE.

**The Taylor Telephone Company**, of Buffalo, N. Y., has been organized with a capital of $20,000. Mr. Thomas B. Englehart is one of the incorporators.

**Mexican Telephone Stock.**—A "turn" in Mexican telephone stock, based on the advance publication of the annual report, carried the price up ⅛ to 1⅛, from which it reacted to 1 $\frac{3}{16}$.

**A Railway Telephone.**—A dispatch of April 15 from Chicago states that Cornelius Spillane, a stationary engineer, living in that city, has invented a device for telephoning between moving trains and railway depots.

**Trying the Turnbull.**—A trial of the Turnbull telephone was made again on the 18th inst., in this city, over the wires of the United Lines. Very lively conversation was carried on with Washington, Cleveland and Chicago without trouble.

**Underground Work in Brooklyn, N. Y.**—Work has been begun on the conduits on Main, Water, Fulton and Raymond streets, Brooklyn, which are to contain the 12 cables of the New York and New Jersey Telephone Company. These cables hold 800 wires, and will be placed in position at once.

**Rates in New York State.**—The representatives of the Bell Telephone Company and Western Union Telegraph Company at Albany have induced the Senate Committee on Cities to raise the rate originally fixed in Senator Reilly's Telephone bill from $5 to $7.50 per month, and with the latter rate the bill has been reported.

**Mexican Interests.**—The Mexican Telephone Company, at its annual meeting in New York on April 14, elected directors as follows: William Reed, J. D. Sargent, E. B. Welch, George W. French, J. H. Goodspeed and A. E. Dennison, of Boston, and M. L. Guiraud, of Mexico. Mr. Sargent was chosen President; Mr. Reed, Treasurer; Mr. Guiraud, General Manager; and Mr. H. W. Gray, Secretary. The only change in the Board is the election of Mr. Guiraud in place of Mr. F. B. Beaumont, who retired from the presidency some months since.

**Must Serve the B. & O.**—A dispatch of April 19, from Philadelphia, says: The Supreme Court decided to-day that the Bell Telephone Company was bound to place one of its instruments in the train office of the Baltimore & Ohio Telegraph Company in this city. When application was originally made for a telephone by the officers of the telegraph company, the Bell Telephone Company declined to furnish one on the ground that under a contract with the Western Union Telegraph Company it was precluded from extending its privileges to any other corporation in the same line of business.

## THE ELECTRIC LIGHT.

**Detroit, Mich.**—The capital of the Thomson-Houston Electric Light Company, of Detroit, Mich., is fixed at $100,000.

**The Brooklyn Elevated Railroad.**—A report is current that electric lights will soon be placed in all the cars of this road.

**New Bedford, Mass.**—The New Bedford Electric Lighting Company has declared a quarterly dividend of 2 per cent. on the old stock.

**Winooski, Me.**—The village of Winooski talks of adopting a tower and electric lights for public use. The lights are already in a large store and a merino mill.

**Street Lighting in New York.**—Contracts have been renewed with the Brush Company and the United States Company for lighting at 70 cents per lamp per night.

**North Attleboro, Mass.**—The North Attleboro, Mass., Steam and Electric Company has organized with a capital stock of $20,000. Mr. George A. Hancock is interested.

**East St. Louis.**—The Daft Electric Light and Power Company, of East St. Louis, is announced with a capital stock of $300,000. Mr. J. Scullin is one of the promoters.

**Time is Money.**—Large steamers going through the Suez Canal save several hours by the use of their electric lights. The money value of the time thus saved is considerable.

**Maine.**—The Sanford Mills Company, Sanford, Me., will establish a new electric lighting plant and light their extensive factory, its surroundings and the village streets by electricity.

**Greencastle, Ind.**—The Greencastle Electric Light Company has awarded the contract for its apparatus to the Jenney Electric Company, of Indianapolis. The installation will be made immediately.

**Pleased Plymouth, Pa.**—At Plymouth, Pa., the people are greatly pleased with the introduction of the electric light. They have now 32 arcs in use in the streets, and will increase the number very soon.

**Far-Sighted Gas Companies.**—The gas companies in Brooklyn, N. Y., observing the great increase in the demand for electric light, have applied to the State Legislature for power to furnish electric light as well as gas.

**Woodland, Cal.**, with 5,000 inhabitants, is the smallest town on the Pacific coast using the electric light. Mr. O. I. Cheeney has put in a Thomson-Houston plant for a local company having a capital of $10,000. The dynamo capacity is 50 arc lamps, of which about 45 are already in use or ordered. At present power is hired, but the directors have bought ground for a station and contracted for a fine Armington & Sims engine. May 1, the company will bid on city lighting. Mr. Cheeney is superintendent, and reports matters as in a very satisfactory shape.

**Somerville, Mass.**—A number of well-known Somerville gentlemen, among whom was ex-Mayor John A. Cummings, held a meeting in Independence Hall, at that place, on April 12, to talk over the formation of a company for the introduction of electric lighting in that city. At present there is not an electric light in Somerville, and the poorly lighted streets have always been a serious drawback to outside people who would like to settle in the city. The policy of the city councils for years in relation to street lighting has caused more adverse criticism than any one thing connected with the city. The new company, if started, proposes to supply the electric lights for the streets, stores and residences, should sufficient encouragement be given.

## APPLICATIONS OF POWER.

**The Van Depoele System.**—Reports from Montgomery, Ala., state that the Van Depoele system used there for the cars of the Capital City Street Railway is working admirably. The trips are regularly made and everything works perfectly.

## PERSONALS.

**Honors to an Electrician.**—Dr. Cornelius Herz, the Director of our French contemporary, *La Lumière Electrique*, has been promoted to the rank of Grand Officier of the French Legion of Honor.

**Duncan, Curtis & Page** is the style of a new patent firm, comprising Samuel A. Duncan, Leonard E. Curtis, Parker W. Page and Robert Duncan. Mr. Curtis and Mr. Page will maintain their connection with the United States Electric Lighting Company.

**Senator H. E. Jackson,** of Tennessee, was appointed last week to succeed the late Judge Baxter in the Ohio and Tennessee Federal Court, and it is supposed, though not certain, that he will hear the proceedings in the patent suit instituted by the government against the Bell patent.

**Dr. Francis Blake.**—One of the most interesting meetings of the Thursday Evening Club, Boston, was that which took place last week, when the members were the guests of Dr. Francis Blake at his hospitable mansion at Weston. The guests assembled in the pretty little theatre to listen to Dr. Blake's talk upon telephones and to examine his recent inventions. Supper was afterward served in the spacious dining-room. Several prominent men interested in telephones were present as guests of the club.

## MISCELLANEOUS NOTES.

**The Root Electric Gas Lighting Manufacturing Company,** of Chicago, Ill., has been organized by Frank P. Root with a capital of $200,000.

**The Broadway Arcade Road.**—The bill authorizing this scheme in its present shape has passed the New York Senate and Assembly, and is now before the Governor for signature.

**Removal.**—The offices of A. G. Day's Kerite, Mr. Clark B. Hotchkiss manager, will be removed May 1 from the Equitable Building to handsome and convenient quarters, 16 Dey street.

**The Westinghouse System.**—Among the electric light orders received by Westinghouse, Church, Kerr & Co. during the past week are the following: State Normal School, Westchester, Pa., 350 lights; Fort William Henry Hotel, Lake George, 200 lights; Wilbur Eliason, Chestertown, Md., 50 lights; increase Trenton central station, 600 lights; besides several smaller orders.

**The Detroit Electrical Works** have closed their New York office, 33 Astor House, and have made arrangements with the well-known house of E. S. Greeley & Co., successors to L. G. Tillotson & Co., 5 and 7 Dey street, to represent them in the East. Messrs. E. S. Greeley & Co. will carry a full line of the Detroit Electrical Company's manufactures, which they will sell at factory prices.

**Underground Work in New York.**—On April 19 the following was adopted by the New York Senate on motion of Senator Daly: That the Commissioners of Electrical Subways appointed for the cities of New York and Brooklyn, pursuant to the provisions of Chapter 499 of the Laws of 1885, be and they hereby are directed and required to report to the Senate within 10 days after the adoption of this resolution what progress they have made in carrying into effect the provisions of said act for the adoption of a general system of operating electrical wires under ground in said cities.

**The Goff Extradition Case.**—Several hearings have been had in the proceedings against Mr. E. H. Goff, as a trustee of the Canada Agricultural Insurance Company. Francis M. Sowdon, who went into the insurance company in 1874, said $22,700 had been owed by the company to Goff when he audited the accounts at the latter's suggestion. Everett W. Burdett, of Boston, an attorney for Goff, testified as to letters shown to him by his client which the latter had received from the counsel for Dumesnal, the assignee of the insurance company. It was promised that if $12,500 was paid by Goff the company would compromise. Goff refused to pay this, and the extradition proceedings were instituted. Mr. Goff said in evidence that he was not indebted to the company, but, on the contrary, he had always claimed that it was indebted to him. He had offered at least a dozen times to submit his differences with the company to arbitration, and had offered to give bonds to make good any indebtedness which might be found against him, provided the company would give bonds to make good any indebtedness to him which might be found against it. These offers had been invariably declined. In the cross-examination it came out that Mr. Goff had given his salary of $3,000 a year to the company, remitting it in order to help the company along. As managing director he had worked from 12 to 15 hours a day for two years in the interests of the company, while the other directors had been indifferent. Mr. R. E. Mace, formerly the cashier of the company, arrived from Lake Superior, and stated in his evidence that the company owed Mr. Goff $22,700 on the day the resolution was passed.

## SPARKS AND FLASHES.

**Electrical Conundrum.**—Why should an electrical tramcar worked by secondary cells be the most economical? Because it dispenses with the usual conductor.

**The Telephone in Politics.**—"Hello! Pan-Electric exchange."

"Hello!"

"Give us 1888."

"Can't do it; the Republican electric light wire has crossed our line and burned us out."

## STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows :

**Telegraph.**—B. & M., b 2½; Western Union, b 63½, a 63¾.

**Telephone.**—Am. Bell, b 163, a 164; Erie, b 27¼, a 27½; New England, b 31, a 31¼.

**Electric Light.**—No new quotations.

## BUSINESS NOTICES.

**Engine Running.**—The Armington & Sims Engine Company have sent us a very neatly printed pamphlet, their Bulletin No. 2, which contains some excellent information on the setting up, starting and running of engines. So much of the economy in all power plants depends upon the engine that every good hint must be welcome, and the work is full of such, besides being a real little gem typographic.

**Jerome Kidder's Electric Medical Apparatus.**—These celebrated batteries continue to maintain the superiority gained some years ago. Now that electricity is recognized to be an important therapeutic agent, a physician is not fully equipped to manage a large practice without understanding the use of this potent remedy. In order to make use of electricity successfully the first essential is a reliable apparatus; Kidder's batteries meet this requirement fully. Physicians contemplating the purchase of such an instrument should correspond with the manufacturers, 820 Broadway, New York.—*Medical Advocate.*

**Dean's Rheumatic Pills**
Are a sure cure, a superior remedy, almost infallible; 50c.
HALE'S HONEY, the great cough cure, 25c., 50c. and $1.
GLENN'S SULPHUR SOAP heals and beautifies the skin; 25c.
GERMAN CORN REMOVER kills corns and bunions; 25c.
HILL'S HAIR AND WHISKER DYE, black and brown, 50c.
PIKE'S TOOTHACHE DROPS will cure in one minute; 25c.

# OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

### PATENTS DATED APRIL 6, 1886.

(1) **339,217**, (2) **339,218. Electric Lamp Socket and Switch**; Frederick Schaefer, Boston, Mass. The first is combined in the second, which is shown in the cut.

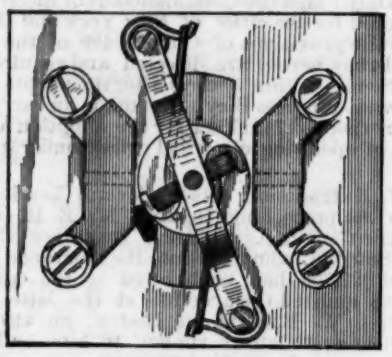
**339,219. Apparatus for Heating Wire**; George H. Scott, Worcester, Mass. Consists in details of construction of a furnace through which the wire passes.

**10,710 (Reissue). Machine for Mending Electrotype Plates**; Jacob North, Lincoln, Neb. Embraces a plunger, a revolvable die and a series of type-sized apertures.

**339,168. Coating for Wire-Drawing**; Charles S. Hall, Addison B. Clemence and H. F. A. Setterwall, Worcester, Mass. Consists of ferric acetate.

**339,253. Incandescent Lamp**; Craig R. Arnold, Philadelphia, Pa. Consists in employing several separate carbons united at one of their ends inclosed in a globe of special form supported in a frame at its end, in which it is rotated, and also in mechanism for automatically rotating the globe or receiver when one carbon may become extinguished or broken, and to throw the next carbon in circuit-connection, and so keep one of the carbons constantly incandescent.

**339,256. Apparatus for Putting Up and Taking Down Wires**; George S. Benedict, Mayflower, Ark. A double



339,298. SWITCH.

windlass is mounted upon guides provided with a stretching device.

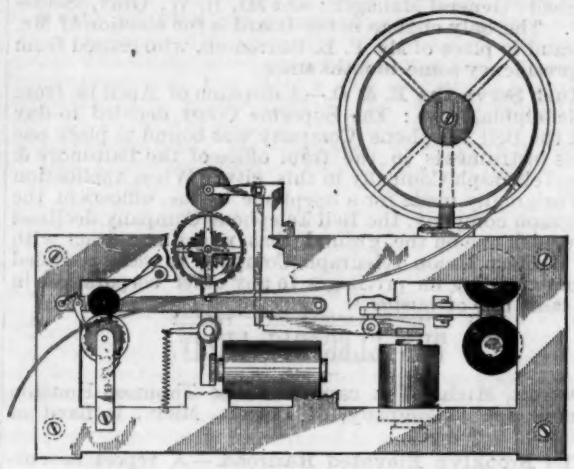
**339,264. Electric Clock**; Julian E. Carey, New York, N. Y., Assignor to the Electric Time Co., same place. Relates to a step-by-step movement, which consists of an electro-magnet, a wheel operated by said magnet and mounted on a shaft whose axis is on a line passing through the core of said magnet parallel with the magnetic axis.

(1) **339,278**, (2) **339,279. (1) Electric Railway, (2) System of Electrical Distribution**; Thomas A. Edison, Menlo Park, N. J., Assignor to the Edison Electric Light Co., New York, N. Y. (1) An underground railway communicates with the surface railway. The former conveys the current and the latter the car. (2) Consists of an improvement upon Bradley's patent 291,141, Jan. 1, 1884.

**339,298. Switch**; Edward H. Johnson, New York, N. Y. The cut shows a plan view. It may be employed with the circuit opened, the operating handle being removed.

**339,312. Printing Telegraph**; William J. McClausland, Philadelphia, Pa. Relates to a receiver which consists of a type-wheel provided with a worm-wheel secured thereto, in combination with a worm adapted to rotate said worm-wheel.

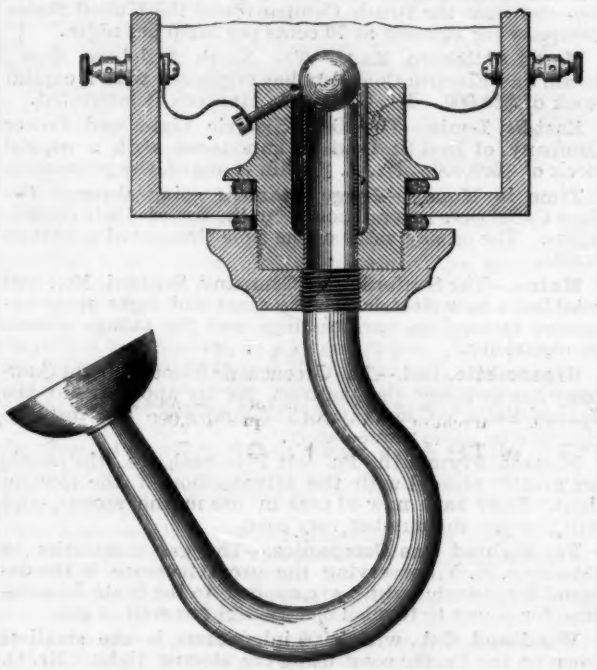
**339,341. Apparatus for Laying Submarine Cables Underground**; Henry C. Spalding, Boston, Mass. Embraces a submarine plow, and means for regulating the plow and paying out the cable.



339,558. STOCK QUOTATION TELEGRAPH.

**339,363. Cut-out**; Perley P. Belt, Columbus, Kansas. Two magnets face each other and close a circuit by undue mutual attraction.

**339,371. Cap Iron for Poles for Suspending Electric Lights**; Thomas H. Brady, New Britain, Conn. Con-



339,499. VALVE TELEPHONE.

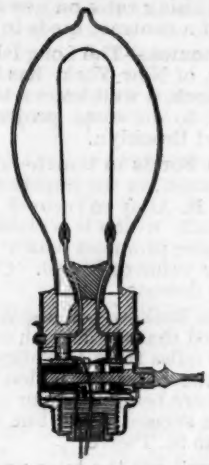
sists in forming the usual tubular body, pivotal lugs and insulator arms all integral.

**339,381. Electric Signal Recorder**; Andrew J. Coffee, Portland, Oregon. Consists of clock-work, an electro-magnet for releasing it, a printing-lever operated by the clock-work, an additional clock-work for feeding a strip of paper on which the impressions are made by the printing-lever, and of a rod for releasing the paper-shifting clock-work from the clock-work operating the printing device.

**339,417. Lightning Arrester**; John Horen, Omaha, Neb. Consists in an electro-magnet connected with the main line circuit and provided with a pivoted armature and a pivoted bar connecting the ground-wire with one part of the lightning arrester and arranged to be moved by the armature of the electro-magnet.

**339,431. Electrotyping**; William J. Ladd, New York, N. Y. Consists of a slotted hanger for the electrodes and an adjuster for the hanger.

**339,449. Multiple Telegraphic Repeater**; William Maver, Jr., Jersey City, N. J. Consists in so organizing the apparatus at the repeating station that a current coming over any one of either series of lines will control the connections of a corresponding local circuit in which there is included an electro-magnet serving in its turn to control the connections of a corresponding second local



339,217. LAMP SOCKET AND SWITCH.

circuit. In each of these second local circuits there is included a repeating magnet. The one series of repeating instruments serves to control the connections of the main-line batteries applied to the respective lines of the series controlling the other series of repeating-instruments, and vice versa.

(1) **339,499**. (2) **339,500**, (3) **339,501. Telephones**; Sylvanus P. Thompson and Philip Jolin, Bristol, Eng. (1) Belongs to the class of valve telephones and is shown in detail in the cut. (2) The diaphragm is secured to two cores which enter opposite ends of a solenoid. (3) Consists of a modified form of mouthpiece or reflector.

(1) **339,540**, (2) **339,541. Treating Wines by Electricity**; Edwin S. Frazer, San Francisco, Cal. Embrace method and apparatus for exposing the wine to the influence of magnetism.

**339,558. Stock Quotation Telegraph**; Patrick Kenney, New York, N. Y. The object is to produce a receiving instrument and operating circuit therefor whereby the record made by it will be divided between two tapes, so that the quotations of two different markets may be separated, or the active stocks separated from the inactive stocks of the same market, the record being thus made more easy of reference. A side elevation is shown in the cut.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W. J. BUCKLEY, Manager Chicago Office, Fort Wayne Jenny Electric Light Co.
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THE BRUSH ELECTRIC CO., Chicago Office, By ALEX. KEMPT, Special Agent.
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